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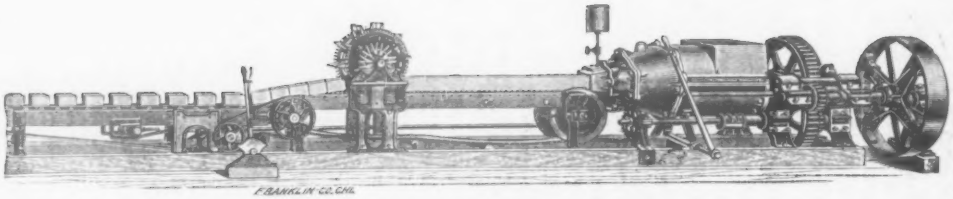

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Paving and Municipal Engineering

VOLUME VIII. FEBRUARY, EIGHTEEN NINETY-FIVE. NUMBER 2.

COST OF MAINTAINING MACADAM IN BERLIN.

NOTWITHSTANDING that Berlin, Germany, has most of its principal streets paved with asphalt to the extent of 1,280,796 square yards, and excellent stone pavements are largely used, nevertheless that city has 472,441 square yards of macadam in its parks and a few streets near the suburbs.

A knowledge of the cost of maintenance of this macadam is exceedingly valuable, because the records have been kept for many years, not only in general tables but by streets and parts of streets, according to traffic passing over them.

The first cost of construction is of little interest, because the cost of maintenance is a constant recurring annual expense, soon amounting to many times the first cost.

Berlin fully recognizes and acts upon the fact that the cost of maintenance of a macadam surface is a function of the weight and quantity of the traffic upon it more than any other destroying agency.

The material used on the macadam and Telford roadways is crushed basalt or trap-rock. Asphalt and stone block pavements are steadily replacing the macadam and Telford streets even in many places in the parks. This has been necessary as a matter of economy as well as health and comfort. The long dry season in Berlin, with the sandy soil, makes macadam either very dusty in the parks, to the great injury of vegetation, or it must be so constantly sprinkled that it becomes disagreeably muddy and wears out rapidly.

The streets which pass across the Thiergarten Park in several directions are subject to business traffic, and have now, 1894, nearly all been paved with asphalt, which replaces the macadam.

The first cost of a Telford or macadam roadway is about the same as in other cities in Europe.

The cost of maintenance of the macadam surfaces of certain streets in Berlin for ten years is given in the following table:

COST OF MAINTAINING MACADAM.

Street Name.	Dollars Square Yard. Maximum.	Minimum.	Average.
Charlottenberger	.345	.044	.247
Lenne	.917	.134	.345
Thiergarten	.442	.100	.219
Spreeweg	.610	.072	.365
Sieges Allee	.355	.058	.175
Bellevue Allee	.538	.100	.112
Grosseweg	.520	.080	.112
Prenzlauer Allee	.353	.072	.173
Landsberger Al	.682	.046	.195
Frankfurter Al	.331	.048	.142
Reinicken Ch	.255	.054	.134
Shoenhauser Al	.245	.064	.177
Averages	.467	.072	.198

The average is not of the maximum and minimum, but of the whole street.

The great cost of macadam is realized by comparing the average cost of maintaining it, under a moderate traffic (19.8 cents per square yard per year), with that of wood pavement at 16.05 cents and of asphalt at 10 cents.

Under the same weight and quantity of traffic maintenance of macadam costs from twice to three times as much as that of asphalt if both are kept in constant good order. Under heavy traffic macadam costs about five times as much as asphalt and stone, and in some places even more. When the cost of cleaning streets is considered macadam can not for a moment hold its own in a city. It is a luxury, however, and should be found on a few pleasure drives leading to the suburbs and in parts of parks. *J. W. Howard.*

STANDARD SPECIFICATIONS FOR PAVING BRICK.

[Both municipal engineers and paving brick manufacturers are equally interested in establishing a generally acceptable standard for paving brick. The existing variance in specifications in different cities is confusing and opens the way for bad work. Uniform

requirement of what may be agreed upon as the best will be more satisfactory to manufacturers and better for the public. In response to the invitation of PAVING AND MUNICIPAL ENGINEERING for a thorough discussion of the subject, expressions of views by some of the leading manufacturers in the different sections of the country are given below.]

To the Editor of Paving and Municipal Engineering:

All brick used in paving should be required to stand certain tests which should be uniform in every particular. If one brick tested for crushing strength is placed on its flat side, all should be placed the same way. As it is now, one engineer might place his brick on edge, another on end, and so on. In the abrasion test, the size of the rattler, number of pieces of iron and weight of each piece should always be the same. The same uniformity should exist in the size of brick tested to be able to make a fair comparison of results. From a manufacturer's standpoint, I am led to believe that 2½ inches should be the maximum of thickness and 9 inches the maximum of length. I would place the minimum of thickness at 2⅜ inches and of length at 8 inches. Four inches seem to be universally conceded as the proper width. I would care little for the analysis of clays from which brick was made, so that it met the most rigid requirements of a test, and I firmly believe that brick manufacturers have been their own worst enemies in endeavoring to have brick used as a pavement which were unfit. The industry is comparatively new, but is approaching an age when definiteness as to just what is required should take the place of uncertainty.

D. V. Purington,
President Purington Paving Brick Co.

To the Editor of Paving and Municipal Engineering:

In regard to the standard size of paving brick, I am in favor of adopting the standard size of the building brick, especially where the paving brick are manufactured from shale; in other words, the size of paver to be 8½ × 4 × 2⅜ to 2½. We think that with paving brick of this size the pavement would be less slippery on account of more numerous joints and footholds for the horse. To the manufacturers it is more desirable in every way to make the paving brick of this size, because it is cheaper to make from the machine and

considerably cheaper to dry and more easily to be handled in setting and in loading, and we find that a larger percentage of the brick are thoroughly vitrified than when made in large block size. For the last reason such size is more desirable to the cities using them, for the pavement will last much longer than will the large blocks which are vitrified on the outside and have a soft core or center that has not been sufficiently burned and annealed. Of course the contractors who buy by the thousand will prefer the large size.

John W. Sibley,
Manager The Coaldale Brick and Tile Co.

To the Editor of Paving and Municipal Engineering:

We would suggest the following as about right and just to both manufacturer and consumer: The brick should be hard burned and thoroughly annealed, free from fire cracks and other imperfections, that will not absorb more than one and one-half per cent. of their weight in water when immersed for forty-eight hours, and not lose more than seven per cent. of their weight when placed in an iron foundry rattler with not less than three-fourths of a ton of cast scraps, with a maximum fall of fifteen inches and revolved 1,000 revolutions. The brick should be 8½ inches by 4 by 2½ inches, allowing a variation of one-eighth of an inch in size. All bricks used in upper course work should be subject to inspection on the above standing, by a competent inspector. We think the matter of size to be of more importance to the public than the other qualities, as work could be repaired with brick on the streets, or the contractor could change from one make to another in case he were being delayed by the supply. The high standard now reached by all manufacturers will protect the public against imperfect material.

J. W. Robb,
Sec'y Clinton Paving and Building Brick Co.

To the Editor of Paving and Municipal Engineering:

Our observation in this section, and an examination of the brick that have been laid, is that brick about 8 to 8¼ inches long, 2½ inches wide and 2 inches thick would about fill the bill, as the size would allow it to more easily vitrify, and thus insure a better quality of brick.

Our idea of the brick paving business is that there should be more attention paid to getting a good foundation, for the brick to be

laid on, and not to let any slight difference in the size of the brick be of any disadvantage to the manufacturer.

Any brick that is well vitrified and laid on a good foundation will make an excellent pavement. *The Barnard Brick Co.,*
By W. C. Bergundthal.

To the Editor of Paving and Municipal Engineering:

In order to make it a paying business it is necessary that the manufacturer of paving brick should dispose of his product entirely. And as there is a considerable percentage of brick in a kiln that are not fit for paving, it is necessary that they should be of a size suitable for any other purpose where a good brick is wanted. Where men have the amount of money invested in business that paving manufacturers have, they are interested in seeing that every brick that goes into the street is of the best quality for the purpose, and they must leave themselves other channels for the disposition of their brick, in order to meet this end. And from my experience, a brick from 2 to 2¼ inches in thickness, by 3¾ inches to 4 inches width, by 8 to 8½ inches long, would be the best size to adopt for all use, as they can be used for foundations, sewers, or any other work where brick are used. This size for street paving affords a better foothold for horses drawing heavy loads than larger brick, and yet bear more weight than is usually required in ordinary traffic. I have adopted this size, and I find ready sale for all No. 2 brick that I have, at very near the same figures that I get for No. 1, and in two instances have been compelled to burn brick for the purpose, in order to supply the demand. *John Gaffney.*

To the Editor of Paving and Municipal Engineering:

We hope that all paving brick manufacturers will endeavor to have no poor brick leave their factory for street purposes, as the future of the paving brick industry will be the "survival of the fittest," as far as street material is concerned.

Somerset & Johnsonburg Mfg. Co.,
Alfred Yates, Manager.

To the Editor of Paving and Municipal Engineering:

Without a doubt in the writer's mind the three-inch block (3″×4″×8½″) is the most satisfactory size of paving brick when

laid in the streets. Smaller blocks present too many corners to chip, and larger blocks are too difficult to vitrify.

Ed. B. Reed,
Sec'y Clearfield Clay Working Co.

HOW TO DETERMINE THE COLOR OF WATER.

AFTER long study on the subject of determining accurately the color of water, we have recently developed in the Boston Water Works a method of taking the color of water. In many supplies the color of the water is an index of the amount of organic matter it contains. People also object to a water which is yellow, even though it may be healthier than another water which is white, but which may contain the germs of disease. It is almost unnecessary to say that it is important to give an accurate mathematical value or expression to the amount of the coloring matter. This is generally attempted by chemists when they provide a chemical analysis, but the color is not always given with even an approximate degree of accuracy.

In the report of the Boston Water Board for the year 1893 will be found an article, with illustrations, which deals with this matter in detail, showing the common sources of error and suggesting an accurate scale which, if adopted all over the country, will enable engineers and sanitarians to make comparative studies with greater accuracy than is now possible.

Desmond FitzGerald.

THE ASPHALT QUESTION.*

THERE has lately been published some very interesting reading concerning this question. To go back a few months, in October, 1892, Consul Pierce made a report which was published in PAVING AND MUNICIPAL ENGINEERING that seemed to leave very little to be said in reference to Trinidad asphaltum from any standpoint. A few months later, Mr. Clifford Richardson published in the *Journal of Analytical and Applied Chemistry*, for December, 1892, and January, 1893, a paper in which he embodied the results of a most elaborate series of technical analyses of Trinidad asphalts. Within the last

* J'n'l of An. Chem. Society.

twelve months there has been published a voluminous report on Trinidad asphalt by Mr. Richardson, in the "Mineral Resources of the United States." In several late numbers of PAVING AND MUNICIPAL ENGINEERING, Mr. D. Torrey has shown that a method of analysis of asphalts may be based on successive solutions in alcohol; and he has also discussed in a very suggestive and intelligent manner the general subject. In the July number of PAVING AND MUNICIPAL ENGINEERING, Messrs. Richardson and Bowen pay their respects to the report of Messrs. Leffman and Sadtler, made to the Citizens' Municipal Association and Trades League of Philadelphia. In the August number of the same journal, Messrs. Leffman and Sadtler reply to their critics. Miss Laura Linton has published a paper in which she gives the result of a very careful research upon the methods heretofore employed in the technical analysis of asphalts. I am also just in receipt of a report upon "The Gas and Petroleum Yielding Formations of the Central Valley of California," by W. L. Watts, of the State Mining Bureau.

I propose, by a general review of these papers, to ascertain where a chemist, who is occasionally consulted in reference to asphalt, might reasonably take his stand.

It is now about fifty years since I first noticed in a number of the *Penny Magazine*, an illustrated article on the "Pitch Lake of Trinidad." My interest in this wonderful phenomenon has never abated. Somewhere late in the fifties, when the Downer Kerosene Oil Co. was ransacking everywhere, but in Pennsylvania, for crude material for illuminating oil that was cheaper than Boghead Mineral, or Albertite, the late William Attwood was sent to Trinidad, where he remained two or three years. Several years after his return it was my good fortune to meet him, and I listened with eager interest to his description of the so-called lake, which he represented as a mass of asphaltum of unknown depth floating upon a veritable lake of water. His experiments in the line of preparing illuminating oil from the asphalt were so far from a success that the late Samuel Downer once facetiously remarked that the Trinidad pitch was, without doubt, derived from right-whales, black fish, etc., while Pennsylvania petroleum was certainly nearly pure sperm oil. Later investigations have shown that both Mr. Attwood and Mr. Downer were considerably mistaken in their conclusions.

The report of Consul Pierce shows that the so-called pitch lake has no definite boundaries, but overflows towards the sea, over the rim of its irregularly circular basin, on one side. His report also shows that the sources, from which the bitumen rises to the surface, are not confined to the strata beneath the so-called pitch lake, but are also found in the strata that underlie that portion of the island of Trinidad adjacent to the lake, to such an extent that unknown areas are covered with masses of asphalt, of unknown thickness. This asphalt, from both inside and outside the lake, was mined and sold, but that from outside the lake was finally distinguished as "land asphalt" by those who chose to do so. Consul Pierce shows conclusively that the same cosmical forces that bring asphaltum to the surface in large quantity at the lake, bring it to the surface at many other points upon the island in smaller quantity, and that, other things being equal, the asphaltum is the same thing in both instances.

In Mr. Richardson's elaborate paper above referred to,[1] he gives results of analyses of a number of specimens that were taken from the lake, and compares them with corresponding results of analyses of a number of specimens taken from the land. He admits that no practical difference can be shown to exist between good commercial samples from either source; but he insists on introducing analyses of lake asphalt that are too soft for commercial purposes, and also of a lot of land specimens that, so far as serving any useful purposes are concerned, are neither more nor less than rubbish. No one familiar with deposits of surface asphalt in Southern California would visit an asphalt bed and dignify the refuse from the numerous fires that, from immemorial periods, have swept over its surface, with the names of "iron-pitch," etc., and think an argument necessary to prove that the ashes, cinders, coke, and half-burned asphaltum are unfit for street pavement. I have seen masses of coke, from fifteen to eighteen inches thick, taken from burnt asphalt beds, and thousands of tons of melted and half-burned asphaltum, in streams miles in length, the analysis of which would afford most convincing proof that they were unsuitable for street pavement. Setting aside the soft pitch on the one hand, and the rubbish on the other, it appears to me, that any

[1] Anal. Appl. Chem., Dec., 1892, and Jan., 1893.

unprejudiced person must admit, that Mr. Richardson's paper proves either too little or too much; either that the methods and material he used prove nothing, as is really the case, or that the results he has obtained prove the practical identity of "lake" and "land" asphalt of good commercial quality.

In the report by Mr. Richardson in "Mineral Resources of the United States for 1893," he goes into the history of the paving industry, and gives some very interesting details, both political and commercial, the argument of which appears to be that while there are other asphalt paving materials to be had in the world, the only material worth considering is that laid by the Barber Asphalt Paving Company, that use and practically own the "lake" deposit, which, after all, is not a lake at all, but fills "the crater of an old mud volcano." He says, "in times past it appears that the continued welling up of pitch at the center of the lake filled the crater and caused it to overflow towards the sea." Here, again, he either proves that the whole of the pitch is worthless, or that the whole deposit outside and inside the crater is practically one and the same thing.

He starts into the discussion of the Technology of Trinidad asphalt pavements with the important information that "The crude pitch is shipped from La Brea in Trinidad in both sailing vessels and steamers." Farther on he shows, by a sort of historical résumé, that a little more care has lately been taken in refining the pitch than formerly, by which the damage resulting from prolonged overheating is avoided to some extent. He then grapples with the cement problem. He says of the fluxing oil, "it should not contain large amounts of hard paraffins, for in this case, while it may be of suitable nature for making cement at ordinary temperatures, it is susceptible to changes and makes the resulting cement too brittle at low temperature and too soft in heat of hot summer sun. The more the oil is of a vaseline nature the better it is. While the oil now in use is a great advance over that of some years ago, there still seems to be room for improvement. The character of an oil may be learned by determining—

"1. Specific gravity.

"2. Flash-point.

"3. Percentage volatile in seven hours at 400° F.

"4. Susceptibility to changes in temperature as revealed in changes in viscosity.

"5. Presence of crystals of paraffin scale.

"Before mixing, the asphalt is raised to a temperature of 300° F., or thereabout, and to produce rapidly a smooth mixture, the oil should be heated as hot as is convenient. The oil is then pumped or in other ways added to the still, and the mixture agitated for several hours with a current of air until it is quite homogeneous. This agitation must be done with great thoroughness to insure a uniform cement, and must be continued whenever the material is in a melted condition, as a certain amount of separation takes place when the melted cement stands at rest. It is, therefore, customary to agitate it constantly with an air-blast when in use as well as in its preparation."[1]

Then he goes on to describe the ingenious toy with which Prof. Bowen, of Columbia College, amuses himself. This instrument is so delicate that, "as the needle (a cambric needle) is not at a normal temperature an allowance must be made." Comment is unnecessary.

In a paper that I read at the Congress of Chemists,[2] held at the Columbian Exposition, I took the position that the residuum in use for softening asphalt that is made from petroleums consisting of paraffins, and that consequently contains paraffins, is not a solvent for asphaltum, and therefore is not a suitable material for an asphaltic flux; as when an attempt is made to incorporate the two materials, the result is a mechanical mixture and not a chemical union as it should be. I based my argument on the results of laboratory experiments, and I now gladly welcome Mr. Richardson to my side, as his very emphatic statements are based upon the much stronger proof of practical experience. In the paper above referred to I further maintained that the custom of "blowing" asphalt, or mixing it by the use of a current of air injected into the molten mass while heated to a high temperature, is all wrong.

Mr. Richardson writes well, and he uses the word "scientific" in a way that sounds well, but I hazard the opinion that if he read more and wrote less, his opinions would have more weight. The

[1] Mineral Resources of the United States, 1893, 651.
[2] Am. J. Sci., Jan., 1894; PAVING AND MUNICIPAL ENGINEERING, Aug., 1894.

first "scientific" paper, in which the effect of the prolonged heating of bitumens was discussed, was published by Boussingault in 1837. He says,[1] after different experiments, the means that I have finally employed in order to free the bitumen of its volatile principles, consists in exposing it at a temperature of about 250° (C.=480° F.?) in a Gay-Lussac oil-bath until it no longer loses weight. This method is prolonged, as it is necessary to heat during forty-five to fifty hours, even when operating on only two grams of material." In a note he adds, "By this method it is impossible to determine the two principles of the bitumen, as at that temperature a part of the petroline is oxydized and passes to the solid state or asphaltine. Technologists in petroleum have known for years that prolonged heating will convert paraffin petroleums into a solid residuum. It has also been known for years that California petroleums can be so manipulated by heat as to convert a large percentage of them into an asphaltic residuum, that will contain varying proportions of material soluble in petroleum ether, carbon disulphide, and chloroform, leaving a residue of coke, according to the temperature to which it has been heated. The percentage of material soluble only in chloroform increases also in proportion to the time during which it has been heated. A patent has lately been issued from the United States Patent Office for a method or process for preparing these residues.

It seems incredible that the scientific adviser of a great corporation, that has the reputation of seeking to control the asphalt paving business of the United States, should be ignorant of these facts. Why, then, this space occupied in the Mineral Resources of the United States, with descriptions of technological processes, that all of the knowledge possessed by the scientific world for the last sixty years condemns as unscientific?

Mr. Richardson has taken great pains to show that he found a good quality of "land asphalt," that contained, if I remember his figures, two per cent. less of matter soluble in petroleum ether than a fair quality of "lake asphalt." This difference he regards as absolutely exclusive of "land asphalt" for paving purposes. He then describes how this "lake asphalt" is refined. He does not say whether refined lake and land asphalt differ by two per cent. of

[1] Ann. Chem. Phys., 64, 141.

matter soluble in petroleum ether or not. He then shows how the refined lake asphalt is softened with a material that, according to his own showing, will not form even a mechanical mixture with the melted asphalt except by constant agitation with a current of air, and that, up to the point when the so-called cement is put into its final resting place upon the street. It is a fair question, whether lake asphalt after this wholly unscientific treatment does not contain a larger percentage of matter insoluble in petroleum ether than would land asphalt when properly manipulated.

Mr. Richardson says, "Washington has had more experience with sheet asphalt pavements and more time and attention have been devoted to both the scientific and practical sides of the industry there than in any other city in the country."[1] If Mr. Richardson has faithfully represented the state of the art in this highly favored city, in what condition must the rest of the country be found where scientific principles have not been introduced into the industry?

Mr. Richardson has been giving his attention to the scientific principles underlying this industry for a number of years. I think it may be safely said that he has had a better opportunity to become an acknowledged scientific authority upon this subject than any chemist living. After what manner has he used this opportunity? He has published a large number of so-called analyses of asphaltum. When making these analyses he either found a method already in use, which his experience proved to be satisfactory, or he invented a better one. In either case, by long continued use, he made the method his own. I am not aware that he has anywhere described his method of analysis, but the terms in which he has stated the results of his analyses, indicate his method with sufficient clearness. He states the amount of water, the percentage soluble in petroleum ether, the percentage soluble in carbon disulphide, the percentage of organic matter not bitumen, and the percentage of inorganic or mineral matter. It is a fair assumption that with Mr. Richardson's opportunities, he thoroughly investigated every step in this process of analysis, and is prepared to show that water, and not volatile oils or gases, are determined as water; that either petroleum ether of any sp. gr., *e. g.*, any light distillate

[1] Mineral Resources of the United States, 1893, 653.

of petroleum can be used in place of any other, with the same results, or that a distillate of a particular sp. gr., obtained from a particular petroleum, should be used. It is further to be presumed that he is able to show that petroleum ether is the best liquid that can be used for this purpose, and that the separation made by its use is sharp and clearly defined. It is further to be presumed, that when this residue, from which petroleum ether has made a complete solution, is subjected to the action of carbon disulphide, that, setting aside the difficulty of obtaining the reagent pure, its action is attended with no serious objections and is complete; that is, it dissolves every trace of bitumen remaining in the residue. All of this should have been proved beyond question years ago. But Mr. Richardson has apparently allowed that two per cent. of difference between lake and land asphalt to so obscure his mental vision that he has left it to the careful and painstaking accuracy of Miss Linton to show that carbon disulphide will not dissolve completely the bitumen from asphaltum, and that boiling spirits of turpentine is an equivalent for carbon disulphide, and is a much more convenient and satisfactory reagent to use.[1]

There are mistakes to which every one is liable and that are properly to be excused; there are others that are absolutely without excuse. I confess that, to my mind, there is no excuse for a man, who, occupying the position of responsibility that Mr. Richardson has occupied, publishes the results of analyses year after year, upon which, as a basis, it has been sought to influence the expenditure of millions of public money, when, in reality, he has made no proper investigation of his processes, and knows nothing respecting the accuracy or proper significance of his results. Mr. Richardson has no right to complain if his constituency hereafter repudiate all of the dicta that he has with, I had almost said, unpardonable arrogance thrust upon the public, in reference to the "Asphalt Question."

I have read the articles of Mr. Torrey with a great deal of interest.[2] They are suggestive. I have not found, by experience, that his method of analysis by solution in alcohol promises any su-

[1] Journal of American Chemical Society, 16, 809.

[2] PAVING AND MUNICIPAL ENGINEERING, Nov., 1893; April, May and September, 1894.

periority over that proposed by Miss Linton. The test of a method of analysis is, other things being equal, the parallelism shown in the results when duplicate analyses are made, side by side. In one instance, with her process, I have obtained results parallel to the third place of decimals. Such close correspondence in work of this kind is not generally to be expected ; but the process, on the whole, has given me very satisfactory results, and the possibility of rejecting altogether the use of carbon disulphide is a great gain.

Messrs. Sadtler and Whitfield remark, in their article in PAVING AND MUNICIPAL ENGINEERING: "While some of the European asphaltic limestones are capable of being used for paving without addition of fluxing material, they have not been found to make as satisfactory pavement as those containing a siliceous base." Why should they? Is not any form of calcium carbonate easily dissolved by rainwater or decomposed by weak acids, such as abound in the street gutters? Will Mr. Richardson please explain why pulverized limestone is required as an ingredient of the asphalt surface used in Washington? Why is it any better than the same amount of fine quartz sand? The reasons given above are sufficient reasons why it is not as good. In California infusorial earth occurs in many localities in close proximity to deposits of asphalt. It is found to be a very superior material with which to temper asphalt.

On page 52 of the Report of the California State Mining Bureau, above referred to, an extract appears from the records of the Standard Asphalt Company. There an attempt is made to compare some of Mr. Richardson's analyses of Trinidad asphalt made with petroleum ether, with other analyses made by G. Q. Simmons, who analyzed California asphalt by using common ether. Other tests are given, made by H. Stillman, who used, presumably, petroleum ether from California petroleum. Miss Linton has shown that the solvent powers of these three reagents, when applied to the same asphaltum, vary widely ; hence they can not be used interchangeably, and results based upon their use can not be compared. The material used should be petroleum ether of sp. gr. 700, equal to 70° B., obtained from petroleum, consisting of hydrocarbons of the marsh-gas series—in other words, "paraffins."

These criticisms have not been made at the suggestion of, or in the interest of, any party to the asphalt question.

S. F. Peckham.

S. F. PECKHAM was born near Providence, R. I., and studied at Brown University. Before he left college he commenced experimenting in the laboratory with petroleum, and immediately thereafter he, with others, established a petroleum refinery at Providence. The civil war coming on, he became hospital steward of the Seventh Rhode Island Volunteer Infantry, serving for a time in the field and later in charge of the chemical department of the United States Army Laboratory in Philadelphia. On leaving the army he went to Southern California, as chemist for the California Petroleum Company. Later, he was for some time engaged in the investigation of California bitumens, for the State Geological Survey of California. To complete this work he returned to New England. For a number of years subsequent to 1880, he was engaged as Professor of Chemistry in several institutions, and at the same time was frequently employed as an expert investigator and writer upon various subjects relating to the technology of bitumens. At the close of 1880, he commenced the preparation of the voluminous monograph upon petroleum, which appeared in the Reports of the Tenth Census of the United States. Professor Peckham is the author of the articles on petroleum which have appeared in Appleton's American Encyclopedia, in the ninth edition of the Encyclopedia Britannica, and in the edition of Johnson's Encyclopedia, now being issued. He has lately turned his attention to asphaltum and the petroleums convertible into asphaltum, for which purpose he has again visited the Pacific coast. His familiarity with the peculiar features of both the Atlantic and Pacific coast petroleums has given him a wide range of facts and experiences upon which to base his opinions.

HOW TO DETERMINE THE MERITS OF ASPHALT.

OPINIONS BY CITY OFFICIALS.

To the Editor of Paving and Municipal Engineering:

I herewith inclose for publication a copy of a circular letter, which I have mailed to the proper authorities in several cities and have asked their assistance as practical men, who have expressed decided views as to the relative merits of asphalts.

I am trying to find out a simple and correct method, whereby a man not a chemist can test asphalts and be able to determine whether they are or are not suitable for paving purposes, and whether one asphalt will make a better wearing surface than another.

As a man of ordinary ability can in a short time learn how to test other cements, it seems to me that there must be some easy method of making accurate tests of asphalt or pitch. If there is not, and the asphalt paving business continues to be shrouded in the mystery of chemistry, how are we, who are intrusted with the duty of letting contracts for asphalt paving and supervising the laying

of the wearing surface, to intelligently perform our duty, unless we can determine at the works and on the street whether the asphalt composition is properly prepared, after first satisfying ourselves that the crude and refined asphalt possesses the necessary qualities?

I trust that I have been able to explain my dilemma and that some of your readers will take an interest in the matter and write me their views and experiences. Very truly yours,

Arthur C. Harris,
President Board of Public Works.

Denver, Colo., Jan. 5, 1895.

[Circular Letter.]

DEPARTMENT OF PUBLIC WORKS, CITY HALL, 14TH ST. ENTRANCE,
DENVER, COLO., January 5, 1895.

DEAR SIR—In Denver we are giving a good deal of attention to the asphalt question and are seeking information as to the relative merits of the various asphalts that are being used for street paving purposes.

We have in use so-called "land" and "lake" asphalts as well as the California product. If your city officials have investigated as to the relative merits of the various asphalts and have any published data pertaining thereto, we will feel under obligations for a copy. We desire to know specially what practical tests have been made to determine the value of the various asphalts now offered in competition for the paving of your streets.

First. As your city officials who superintend street paving have expressed decided views as to the relative merits of asphalts, we presume that they have used such methods as would guide a man of ordinary intelligence and judgment in determining whether one asphalt is, or is not, adapted for street paving purposes, and whether one asphalt possesses qualities which would entitle it to be selected in preference to another, with a certainty or strong presumption that it will make a better pavement and wear longer if handled with equal skill.

Second. Have you adopted any manner or form of test that a person not a professional chemist can use to determine when an asphalt is submitted, that he can test and decide with certainty whether it is adapted for use in street paving or not? If you have, please state the appliances and material other than asphalt used in the test, also process, conditions by and under which it is made, the results which should be produced to prove its fitness for street paving, and the results produced, or not produced, that would prove it not to be adapted for street paving; also such other information or details or directions to guide a person in making the test with unerring results, as you consider necessary.

Third. We, as a board having the superintendency of the laying of asphalt pavements, experience great difficulty in finding men sufficiently conversant with the manipulation of asphalt, who are able to determine whether or not the crude or refined asphalt offered by contractors possesses the necessary qualities to fit it for use for street paving; hence the necessity for the above queries.

Fourth. Is it, in your opinion, a fact that skill in manipulation is as important a factor in producing good results in asphalt paving as the quality of the asphalt itself?

Fifth. If a city is offered an untried asphalt, which possesses all the chemical and physical tests that experts deem necessary at a lower price than is asked for the tried asphalts, is it advisable that that city accept the offer, if the bidder satisfies the proper officers that he possesses the necessary skill and is prepared to give sufficient bonds, with a guarantee to keep the street in repair for five or ten years, and resurface if necessary?

There is millions in the asphalt paving question to the tax-payers if competition can be encouraged; hence the necessity for calm, unbiased research by those officials, whose duty it is to look after the interests of the people.

The writer of this has patiently and persistently studied this great question for nearly two years, but as the major portion of what is written on the subject seems to be in the interest of some one variety of asphalt and condemns unqualifiedly all others, so that one who seeks light on the question, if guided solely by these conflicting opinions, is left in a maze of doubt and distrust and knows not what path to take to lead him to the goal of absolute certainty, consequently, this is written with the view of gleaning from "practical" men, "practical" information.

Thanking you in advance for courtesies to be received,

I am very truly yours, ARTHUR C. HARRIS,
President Board of Public Works.

Mr. James H. Windrim, director of public works in Philadelphia, in reply, stated that he had referred the letter of Mr. Harris to the chief of the bureau of highways, whose report is given below. In 1893 bids were invited for asphalt paving in Philadelphia, with the idea of encouraging the greatest competition for this character of work. The invitations for proposals required the parties making the bids to submit their own specifications, setting forth the ingredients to be used by them and the method of application to the street. There were a number of streets designated by councils to be paved with sheet asphaltum by the department, and as the main thoroughfares of the city are occupied by passenger railway companies, who are required to repave them on account of grants given them to introduce electric trolley systems on their roads, the list of streets to be paved by the city were in the main minor thoroughfares.

"Chemical analyses," Mr. Windrim writes, "continuously made of the asphaltic composition used in the street may insure uniformity in the mixture, but I am of the opinion that a practical test of the value of an asphalt composition for street paving will be obtained by laying it, which will prove its endurance, wearing qualities and the effects of climate and temperature upon it; this is the only safe method to ascertain whether the material has the properties neces-

sary for a satisfactory street pavement. This city is now paying for this experiment, and in a few years the relative value of the several varieties of asphalts will be better known. The greater portion of the asphalt sheet paving in this city has been laid with Trinidad Lake asphalt, under a guarantee of five years; the time-period of guarantee for all asphalt pavements should be fifteen years."

The report of Mr. George A. Bullock, chief of the bureau of highways, is as follows:

First. The contractor should give the formula, together with the samples of the materials which he uses in the preparation of his asphaltic mastic. The relative merits of the ingredients can only be determined by chemical analysis During the process of its manufacture and application samples should be taken from the work as it progresses, and tested by chemical experts, to see that the proper proportions are maintained according to the formula submitted by the contractor.

Second. We have not. But the report of the Commissioners of the District of Columbia fully covers this matter of tests. I do not know of any place where fuller information can be obtained than from them, they having devoted a great deal of their time and attention to the matter.

Third. My report for 1892 takes up this matter fully, and I enclose a copy of it. The experience of the city of New York should be taken as a test of that kind, a statement of which can be found on pages 15 and 16 of this report.

Fourth. Undoubtedly, and if possible, the machinery furnished for manipulation should be as nearly automatic as possible, so there should be no trouble about the proportions of the ingredients, which should be at all times the same. The temperature, of course, can be observed by an inspector watching the thermometer.

Fifth. This is a matter for the officers of the city to determine themselves. In accepting any new product, either of stone, brick or asphalt, that has not been in the market before, ordinary prudence and care should be exercised The use of any material for paving purposes, and particularly asphalt (which takes a series of years to determine its relative qualities in comparison with other products which are known to the market, and have been for years), is such, that it is good policy to permit a new company to try their material at their own expense in the section of the city where it will be subject to ordinary traffic, to see how it wears. It seems but reasonable to believe that parties having a new product should be willing to stand this test previous to asking a corporation to accept material which is untried.

No engineer or contractor would accept a stone or paint for a building merely upon an examination by a chemical expert. It should be tested by actual use, and that is the only practical way of determining its adaptability to the structure in which it is used.

In the year 1894, asphalt paving was laid in this city by the Vulcanite Paving Company, who used Trinidad Lake asphalt; Pennsylvania Asphalt Paving Company, who used Bermudez asphalt; California Petroleum and Asphalt Company

who used California Alcatraz, or California asphalt, and the Philadelphia Paving and Construction Company, who used a regular asphalt composed of a mixture of Sicilian asphalt and Verwhole.

The latter is the German asphalt, a bituminous limestone; the Sicilian contains an overplus of bitumen. The mixture of these two materials in the proper proportions makes what is known as European Rock asphalt.

The effect of traffic on the paving composition is the only test that can be relied upon to show their merits for street paving purposes.

DEPARTMENT OF PUBLIC WORKS,
CHICAGO, ILL., January 12, 1895.

Mr. A. C. Harris, President Board of Public Works, Denver, Colorado:

DEAR SIR—Replying to the several inquiries contained in your circular letter of January 4th in relation to asphalt pavements, I beg to state as follows:

There are, in this city, one or two streets paved with the so-called land asphalt, and the results have not been satisfactory. The city has paved no streets with the California product, and we have no published data pertaining to asphalt pavements.

Skill in the manipulation of asphalt in the mixing thereof is considered a very important factor in securing a good and substantial pavement.

If a city is offered an untried asphalt which possesses all the chemical and physical tests which experts deem necessary at a lower price than tried asphalts it certainly appears advisable for the city to accept the offer if the bidder satisfies the proper officers that he possesses the necessary skill and is prepared to give sufficient bonds, with a guarantee to keep the street in repair for five or ten years and resurface if necessary.

There has been adopted in this city no manner or form of test that a person, not a professional chemist, can use to determine whether an asphalt is adapted for use in street paving or not.

Up to recent date all ordinances passed for the improvement of streets with asphalt specified that the asphalt should be obtained from Pitch Lake on the Island of Trinidad. To insure a compliance with the terms of the ordinance a certificate was required to be filed from the warden at La Brea on the Island of Trinidad that the asphalt shipped was taken from Pitch Lake.

JOHN MCCARTHY, *Commissioner.*

DEPARTMENT OF PUBLIC WORKS OF CITY OF BUFFALO,
BUFFALO, NEW YORK, January 10, 1895.

A. C. Harris, Esq., President Department Public Works, Denver, Colo.:

DEAR SIR—Replying to your letter of the 2d, I beg to say that the following kinds of asphalt have been used in this city for pavements: Land and lake asphalt from Trinidad, also a mixture of Lake Trinidad and German Rock, and another mixture of Kentucky Rock and German Sicilian Rock. With the exception of the land asphalt, all of the asphalts and mixtures have proven good when properly laid. There were a few streets laid with land asphalt. Most of them disintegrated within a year, and had to be resurfaced.

The only practical test of the value of an asphalt for pavement that we have, or know of, is to lay it upon a street and observe the effect of traffic and climate upon it for a period of years.

Our specifications provide for chemical analysis and inspection at the works, but this has never been carried out, it having been deemed an unnecessary expense. We have not had occasion to determine from samples of crude or refined asphalt if they were adapted for paving, and if we did have should turn them over to a chemist who had made a specialty of asphalt examinations.

It is a fact that skillful manipulation is as important a factor in producing good results in asphalt paving as the quality of the asphalt itself. This applies to manipulation at the works as well as after the material is delivered on the street.

In the case you cite of a city being offered an untried asphalt, showing satisfactory chemical and physical tests at a lower price than tried and satisfactory asphalt by responsible parties, guaranteeing the pavement for five or ten years, I think it would be advisable to let a limited amount yearly until its value can be established under actual conditions of traffic and climate.

S. J. FIELDS, *Chief Engineer.*

STREET DEPARTMENT, CITY HALL,
BOSTON, Jan. 10, 1895.

Mr. Arthur C. Harris, President Board of Public Works, Denver, Colo.:

DEAR SIR—In answer to your communication of January 3, I would state that this city has not made any extensive tests on asphalts, as we only use standard asphalt in our work, and do not experiment with anything that has not been proved in other places to be a standard article. The two kinds of asphalt that that we use here are the Trinidad asphalt, furnished by the Barber Asphalt Paving Co., and the Sicilian Rock asphalt. Yours truly, C. R. CUTTER,
Acting Supt. of Streets.

OFFICE OF E. H. KEATING, CITY ENGINEER,
TORONTO, Jan. 9, 1895.

Arthur C. Harris, Esq., President Dept. of Public Works, Denver, Colorado:

DEAR SIR—I beg to say that in this city we have used only Trinidad asphalt for street paving purposes, although we have a small piece of sidewalk laid experimental of German Rock asphalt. The Trinidad asphalt which has been laid here is partly rock (lake) and partly land. In regard to the question of tests, as far as I know, there are no tests by which a person other than a chemist can decide definitely as to the quality of any two different kinds of asphalt. Even a chemical analysis, alone, I consider quite insufficient to decide with certainty as to whether an asphalt is fit or unfit for paving purposes. The constituent parts of different asphalts are so various, both chemically and physically, that in addition to any chemical tests certain physical and practical experiments must be made with the material under trial before any definite conclusion can be arrived at as to its value for paving material.

In regard to the question of your fourth paragraph, I certainly think that a good quality of asphalt is essential for a good pavement, but a good asphalt badly manipulated means a poor pavement, while a comparatively poorer asphalt well handled and properly laid may produce a lasting pavement.

In regard to your fifth question, I certainly think that if a city is offered an untried asphalt possessing the chemical and physical tests necessary to make a good pavement, and at a much lower price than is asked for a tried asphalt, it

would be advisable, before awarding the contract to the bidder, that proper bonds be taken and a sufficient sum as a guarantee be kept back, in order to make good any defects that might ultimately arise in the pavement.

I am also forwarding you by this mail a copy of our specifications for paving work, in the general conditions of which you will see a clause by which we require a contractor not only to guarantee the pavement for a given period, but also, if necessary, the city engineer has the power, at the end of that time, to compel the contractor to continue the guarantee for an additional five or ten years, an additional sum being paid the contractor for that purpose.

It is also the practice here to hold 15 per cent. of the money until the final term of the guarantee has expired. The city allows the contractor 4 per cent. per annum on the money thus held back. In addition to this the contractor has to give satisfactory bondsmen. H. D. ELLIS, *Roadway Engineer.*

The asphalt pavements of St. Paul have all been laid by the Warren-Scharf Asphalt Paving Company, and are made of Trinidad Pitch Lake Asphalt, though recently the Bermudez Company was admitted to competition in the specifications for the paving of one of the business streets of the city. Mr. L. W. Rundlett, city engineer of St. Paul, in replying to the inquiries of Mr. Harris, writes :

As one of the city officials who has had charge of the street paving in the city of St. Paul, I would say that the result of our experience has demonstrated the fact that for residence streets and for business streets with ordinary traffic, the asphalt pavement has proved more satisfactory than any other pavement that we have used.

Second. We have never adopted any manner or form of test for determining whether an asphalt was or was not fit for street paving, and I doubt very much the practicability of any such test.

Third. Our experience has been similar to your own in finding any experts whose opinion on a crude or refined asphalt is of any value.

Fourth. We are strongly of the opinion that skill in manipulation is a very important factor in producing good results, but I hardly think that the best manipulator could get good results from a poor material.

In answer to your fifth inquiry, I should say "yes" if the security is ample and the city is sure it can enforce the penalty. We have always found it very difficult to hold the bondsmen, consequently the reliability of the contractor should be very carefully considered.

In our contracts we have required that the pavement shall be guaranteed for a term of ten years without expense to the property-owners, and have retained fifteen per cent. of the contract price for that period of time to insure making necessary repairs (in addition to a bond for the full amount of the contract) upon which the city pays five per cent. interest. Under these conditions we always allowed the contractor, as far as the asphalt surfacing was concerned, to mix the material to suit himself. In fact, it would seem unjust to take any other course as long as we hold him responsible for the result. I know of no locality except

the city of Washington where they undertake to dictate absolutely the percentage of the different kinds of material to be used, and this is done there under an expert.

Mr. Chas. C. Brown, city engineer of Indianapolis, says that the specifications of that city require the use of "asphalt from Trinidad Pitch Lake or asphalt equally as good." In reply to the inquiries he says:

First. Our city officials having charge of street paving, including myself, have investigated the various materials as to their chemical and physical characteristics, and their action in use, and feel safe in their expressions of opinion regarding them.

Second. Our judgment regarding a paving material is derived from a study of its action in use, believing that actual use is the only complete test of paving materials. No laboratory tests have yet proved satisfactory as indications of the value of a paving material.

Third. When an asphalt has been shown to be good material for paving, tests are prepared, and it is easy thereafter to determine whether the asphalt bid upon is furnished.

Fourth. Skill in manipulation is equally as important as quality of material. Good material can be entirely spoiled by poor workmen. Our specifications demand evidence of ability to lay good pavement as well as evidence as to the value of material.

Fifth. Our policy has been thus far to try no experiments, but to let contracts only for materials which have been tested in actual use to contractors who show evidence of ability to lay good pavements.

W. Tweeddale, city engineer of Topeka, could give little information regarding the asphaltic pavements in that city, as the work was done prior to his appointment as engineer, but he says that in the original construction Trinidad Lake asphalt was used, and repairs are now being made with California asphalt. He adds, "There is probably less in the kind of asphalt used than in the skill and honesty of the contractor. From a somewhat extended experience and observation, I am led to believe that properly prepared specifications, carried out under a superintendent of intelligence and character, even if not a chemist, will suffice for the obtaining of satisfactory results."

ENGINEER'S OFFICE, CITY HALL,
ERIE, PA., Jan. 18, 1895.

A. C. Harris, Esq., President Board of Public Works:

DEAR SIR—In reply to favor of 5th inst., I would answer questions as follows:

First. Paving in this city is under charge of city engineer's department to-

gether with street committee of councils. We have expressed no decided views on relative merits of asphalts and have been governed by reports of other cities, and actual wear of materials on our streets.

Second. We have not adopted any test to determine whether an asphalt submitted is adapted for street paving. That would require a chemical laboratory and an expert, and our city has not advanced far enough for that yet. I understand there are not more than half-a-dozen "experts" in the country, who are standard authority on qualities of asphalts. Our standard asphalt pavements are laid under a ten-year guarantee with approved judgment bond. This ought to, and does, protect the city's interests.

Third. I have no doubt of the difficulty experienced.

Fourth. I consider the skill in "cooking" and laying very essential. On several occasions we have had samples of asphalts tested by expert chemists. Both of the "mixture" and the top and binder, after being laid. I quote from the report of Prof. F. T. Aschman, Pittsburg, Pa., in speaking of samples of "top" on West Seventh street, tested by him: "The samples are chemically equal to standard asphalt pavements in common use. Whether they are mechanically so, that is whether they were properly put down as to temperature, pressure, etc., it is, of course, impossible for me to judge at this distance."

Fifth. I would consider that such an asphalt might be admitted if favorable reports had been received from places where used, and if proper guarantee and bonds were given. Nearly all of the nine and three-tenths miles of sheet asphalt in this city is Trinidad Lake. The new specifications which I have prepared and submitted to the councils, admit Bermudez. This was done on favorable reports received from Detroit, Chicago, Philadelphia, Washington, and other cities. A proposition has been made to admit "Trinidad Lake" and "California." If they are admitted it will be under similar conditions as to reports, bonds, etc.

George Hall, City Engineer.

BOARD OF PUBLIC WORKS, DEPARTMENT OF ENGINEERING,
KANSAS CITY, MO., Jan. 21, 1895.

Arthur C. Harris, Esq., President Board of Public Works, Denver, Colo.:

DEAR SIR—Your circular letter concerning different kinds of asphalt for street pavements, and addressed to the board of public works of this city, has been referred to me for reply.

I am sorry to say that we are unable to give you any definite information to aid you in your investigation.

Our city charter gives to the resident owners of property abutting on a street the right to select what material shall be used in paving it, and the manner of laying the same. This privilege is pretty generally taken advantage of by the property-owners, who are more or less influenced by contractors and agents interested in the sale of different kinds of paving material.

This selection, when made in favor of asphalt, usually specifies the particular kind, and sometimes indicates, also, the particular company that shall do the refining of same.

If brick is selected, the particular yard from which the brick are obtained is often indicated.

Under these conditions the duty and privilege of the board, in the matter of

street pavement, is confined, principally, to supervising the work and making the assessment for the cost of the same.

With one exception, all the asphalt pavement laid here has been put down by the Barber Asphalt Company. One short section of Walnut street was built by the North American Asphalt Company about four years ago, using Utah Rock asphalt. It was afterward repaired with California asphalt. It is, and has been for a year or more past, again in a bad condition. In many places it seems to have slipped on the concrete foundation.

I am unable to say whether the fault is a defect in the quality of the asphalt, or lack of suitable appliances for laying and making the mixture, or both. I am informed that the plant was improvised for this particular job, and very crude and imperfect in every detail, almost.

We have made neither chemical nor mechanical tests of the asphalt used here, and are not provided with the necessary appliances for doing so. Some simple method, such as you seem to be in search of, by which the merits of any asphalt could be determined off-hand and with certainty, would be of great value in all large cities, but such a rule is perhaps too much to hope for at present.

From the fact that engineers of the largest experience in this branch of the profession, to be found in this country, viz.: those in charge of the municipal engineering at Washington, D. C., do not yet specify absolute proportions for the paving compound, when the best known and refined asphalt is used, and that defective spots which require renewal within a year or two, sometimes occur in pavements laid by the oldest and best companies, it would seem best to let owners of the product, rather than the tax-payers, do the experimenting with new and untried asphalts. It is to be hoped that the time will soon come when cities can secure the services of thoroughly competent and honest experts, to test and inspect all asphalts used. Then we may expect what the city of Washington seems to have now—the benefit of competition in the business.

Yours truly, H. H. FILLEY, *City Engineer.*

P. S.—Your letter was referred to me without instructions, therefore the board is not responsible for any of the opinions offered. *H. H. F., C. E.*

KINDS AND COST OF PAVING IN EIGHT CITIES.

MR. JAMES RICHIE, C. E., Cleveland, O., has collected some valuable data relative to the cost and methods of construction of street pavements in the larger cities, for comparison with the conditions in Cleveland. Reports received from Buffalo, Chicago, Milwaukee, Indianapolis and Memphis were complete. Partial reports were received from St. Louis and Pittsburg, and New York, Philadelphia, Boston, Cincinnati, Detroit and Louisville failed to respond. The following is a summary of the information:

EXPENDITURES AND TAX RATES.

Cities.	Pop. 1890.	Miles of sts.	Miles Paved.	Expenditures, 1893.	Annual Average.	Tax rate per $1,000.	Total tax per Capita.	Bonded Debt 1893.
Cleveland	261,353	544.71	95.71	$860,992	$323,031 (10 years)	$27 50	$15 40	$7,200,128
Buffalo	255,664	702.78	302.73	1,618,794	1,088,078 (10 years)	15 45	13 45	12,975,829
Chicago	1,099,850	2,467.00	1,003.00	3,598,536	3,026,779 (5 years)	46 08	10 80	18,097,221
Milwaukee	204,468	261.00	55.00	154,000	156,900 (10 years)	21 00	13 96	3,260,000
Indianapolis	105,436	299 60	41.00	766,043	555,960 (3 years)	17 60	15 00	1,899,500
Memphis	64,586	88.00	39.32	63,688	92,000 (10 years)	17 60	10 75	3,130,000
St. Louis	451,770	767.95	359.45	.....	.....	13 80	11 25	21,376,021
Pittsburg	238,617	220.00	175.00	763,301	.....	13 00	13 00	8,483,995

KINDS OF PAVING AND COST.

Cities.	Block stone on sand.	Block stone on concrete.	Brick on concrete.	Asphalt on concrete.	Wood Block.	Macadam and telford.	Block stone on sand.	Block stone on concrete.	Brick on concrete.	Asphalt on concrete.	Wood block.	Macadam.
Cleveland	77.40	.25	.....	2.90	.....	.....	$2 70	$5 51	.....	$2 85	.....	.....
Buffalo	.....	1.20	3.33	177.00	.....	2.33	.....	3 50	$2 75	3 00	.....	.....
Chicago	.....	22.65	1.10	20.10	648.40	310.80	.....	3 00	2 10	2 85	$0 95	$0 80
Milwaukee	.....	12.00	.....	20.10	648.40	310.80	.....	2 80	.....	2 28	1 03	.....
Indianapolis	.....	.....	13.77	20.82	2.44	2.28	.....	.....	1 85	1 55	.....	.....
Memphis	12.46	1.97	2.71	.....	1.86	13.00	1 92	4 34	2 85	.....	1 92	1 15
St. Louis	.84	45.06	.....	5.27	8.35	800.00	.....	3 00	.....	2 75	2 75	1 75

Cleveland is the only city reporting the laying of brick on a sand foundation. It has 15.40 miles of this kind of paving, the cost of which was 90 cents per square yard.

THE NEW STREET-CLEANING COMMISSIONER OF NEW YORK.

COLONEL GEORGE E. WARING, JR., has been appointed street-cleaning commissioner of New York City, by Mayor Strong, and entered upon the discharge of his duties on January 15th. He will re-organize the department, and announces that he will inaugurate new methods.

Colonel Waring is in his sixty-first year, and was born at Poundridge, N. Y. He was educated at College Hill, Poughkeepsie, and later studied agriculture with the late James J. Mapes. In 1855 he took charge of Horace Greeley's farm, at Chappaqua, and in 1858 he was given the direction of the agriculture and drainage of Central Park, New York. In 1861 he went to the war, as major of the Garibaldi Guards, and after three months' service was appointed major of cavalry, by General Fremont. In St. Louis, he raised six companies of cavalry, called the Fremont Hussars. This command was merged into the Fourth Missouri Cavalry, of which he was commissioned colonel, and with which he served until the close of the war. In 1867 Colonel Waring went to Rhode Island, as manager of the Ogden Farm, where he staid ten years. Then he began practice as a drainage engineer. After the severe yellow fever epidemic in Memphis, in 1878, Colonel Waring devised a system of sewerage for that city, which has been adopted by many cities and towns throughout the country, and is increasing in favor. He was an expert and special agent for the tenth census, with charge of the social statistics of cities. Since 1882 he has been a member of the National Board of Health. In his practice as a drainage engineer, Colonel Waring has been called in consultation in many cities of the country. He is connected with the sewerage of New Orleans, as consulting engineer, and is just about completing a system of sewerage and drainage for Brunswick, Ga., where he was called after the yellow fever epidemic of 1893.

COL. GEO. E. WARING, JR., C. E.

CURRENT INFORMATION.

STREET CLEANING IN DETROIT.

The cost of cleaning paved streets in Detroit in 1894 was about 2¾ cents per square yard for the year, but this low average was only reached by the infrequency of the cleaning of pavements in the outlying districts.

Some streets are cleaned daily during the summer, others three times a week, others twice a week, others once a week, and others less often as needs demand. Machine sweeping and machine brooms cost an aggregate of $15,772.17, and the labor and teaming on paved streets in addition to the work of the machines, cost $85,958.89, besides $1,402.28 for tools and repairs. Labor and teaming in the cleaning of alleys cost $21,796.47. The cost was made unnecessarily high, however, by a resolution of the city council, requiring that $3.50 per day of eight hours should be paid for teams, which was 5 cents per hour more than the union rate, and $1.50 per day for labor, which was more than was paid by private arrangement for some kinds of skilled labor. The board claims that if left to its own methods, it could have saved the city over $30,000.

The board regards the contract system of street-cleaning as a failure. It believes a combination of the day labor and contract system might be made that would prove beneficial to tax-payers and to industrious and willing laborers as well. "For instance," the board says, "the paved streets within the mile-circle, approximately, might be divided into a sufficient number of districts for the work of gathering and hauling away the sweepings, and for such districts laboring men could compete in the bidding, the capital necessary being almost wholly their own labor. The sweeping in these districts should be done by the city, or might also be let by contract in the machine-sweeping districts, as only the man and team is to be supplied, the city owning the machines. The work of the outer paved districts could be combined with the working or grading of unpaved streets by day labor."

The board thinks that under the system it proposes, it can clean twenty miles more of paved streets with an appropriation of $30,000 less than has heretofore been granted for this work.

FAULTY SPECIFICATIONS.

There has been much dissatisfaction in Houston, Texas, over the paving brick specifications in use in that city. There has recently been some newspaper discussion of the subject, in which a few of the objectionable features have been brought to attention by the Houston *Post*. Regarding the quality of brick to be used in paving streets, the requirements of the specifications, the *Post* says, are particularly and peculiarly unsatisfactory. The specifications say in one place that the brick so used "must be hard burned vitrified brick, specially burned for street paving," and in another that "the vitrified brick shall be of the character and quality as used in brick

paving, and shall be of the standard established by the sample deposited in the office of the city engineer." From which it will be seen that there is no absolute standard set up except by the contractor himself, when he deposits his sample.

Webster defines "vitrified" to mean "to convert into or cause to resemble glass or a glassy substance, by heat and fusion." The technical definition is something of a modification of the real meaning of the word, though not so very much. An authority on street paving and brick making defines vitrified brick as "one that has been subjected to a degree of heat sufficient to cause the fusible ingredients of the clay to unite the particles together into a homogeneous mass." The same authority says a brick may be vitrified in part, without being vitrified throughout; that is, the degree of heat may be sufficient to penetrate with the required intensity the portions of the brick next the surface and yet leave the inside entirely unvitrified and porous. In this case the vitrified shell is easily broken through, leaving the remainder of the brick soft and easy to wear away. The *Post* says that "a comparison of the Garrison brick, which has been used in the Houston paving, with the first-class vitrified brick from Galesburg, Ill., or even with the lower grade brick from Fort Scott, Kan., plainly shows the inferiority of the Texas article as a solid, serviceable substance for street paving."

A CHICAGO COMMITTEE'S REPORT ON STREET PAVING.

The special committee appointed several months since by the council at Chicago, to gather data relative to street paving, has submitted its report to the council. Alderman Madden, who is chairman of the committee, has for several months been in correspondence with United States consuls in the largest European cities, as well as with engineers of the most progressive American cities. The report says:

"Chicago should adopt a well digested, carefully prepared plan of street improvement. For the central business district there should be selected a material for paving suitable to the requirements of the traffic on those streets, and only that kind of pavement should be permitted within that district. For the semi-business and strictly resident streets pavements suited to their wants should be selected and no ulterior motives on the part of any person whatever should be allowed to interfere with the accomplishment of this plan. Street car companies, gas, electric light, telephone and all the other corporations which use the street pavements either under or upon the surface should be compelled to make their work, their plans, and their methods of construction subservient to the maintenance of perfect street pavements. Some means should be devised to compel corporations holding street franchises to restore pavements to conditions equal to those that existed before they were torn up.

"Only three kinds of paving materials have answered all conditions and all requirements for street pavements. They are brick, granite blocks and asphalt. Granite is best for streets upon which there is very heavy traffic. Asphalt pavements are growing in favor. Brick pavements have been laid in many cities in this country, with more or less success. Wood block pavement has been an utter failure in America. It is scarcely necessary to discuss macadam. It has been

abandoned everywhere, even in villages. In estimating the desirability of different kinds of pavements these qualities should be taken into consideration: Cost, durability, cost of maintenance, sanitation, noiselessness, facility of repair, resistance to traction, ease on horses, ease on vehicles, and appearance. The general experience of city engineers would seem to classify the pavements according to these qualities in this way:

First Cost—Granite most expensive; then asphalt, brick, wood blocks, macadam.

Durability—Longest lived, granite; next, asphalt, brick, wood, macadam.

Cost of Maintenance—Cheapest, granite; next, asphalt, brick, wood, macadam.

Sanitation—First, asphalt; brick and granite about equal; wood last.

Noiselessness—Wood first; then macadam, asphalt, brick; granite, noisiest of all.

Facility of Repair—Under the improved methods asphalt is the easiest to repair, for work can be done without the street being closed. Granite and brick rank about equal, wood next, and macadam last.

Least Resistance to Traction—Asphalt, brick, wooden blocks, granite, macadam.

Easiest on Horses — Wooden blocks, brick, asphalt, granite.

Easiest on Vehicles — Asphalt, wood, brick, macadam, granite.

Appearance—Asphalt, brick, wood, granite, macadam.

"A most important factor in permanent street pavements is the method of construction. When the soil of the graded street has been thoroughly rolled and hardened, and upon it has been built a six-inch bed of concrete, made of cement and properly prepared, the really durable portion of the street has been completed. The wearing surface is placed on top, and it may be taken off from time to time and new substituted at comparatively slight cost. It is desirable also that there should be no depression in the spaces between paving blocks, as every joint becomes a tiny sewer, which becomes a breeder of disease. In European cities the width of wagon tires and the method of shoeing horses is regulated by law for the protection of pavements. All pavements laid in Chicago should be guaranteed by the contractor for at least five years, and the conditions of this guarantee be rigidly enforced."

DESTRUCTION OF PAVING UNDER CORPORATION FRANCHISES.

In his last annual report, Mr. Alfred T. White, city works commissioner of Brooklyn, says that in that city the tearing up of the streets by the many corporations enjoying municipal franchises or legislative grants, has reached unprecedented proportions. Much of this disturbance of streets was done under privileges granted to gas companies twenty to thirty years ago, and not used before. Satisfactory street work can not be maintained under such conditions, and he asks for protection against abuses of the privileges granted to these corporations.

MEETINGS OF BRICK MANUFACTURERS.

The ninth annual meeting of the National Brick Manufacturers Association will be held at Cleveland, in the Hollenden House, February 12, 13, 14, and 15. Special railroad rates on the certificate plan have been arranged for over all lines composing the Central Traffic Association; the Trunk Line Association; the Boston Passenger Committee, and the Southern Passenger Association, which cover all territory east of the Mississippi river. Certificates, when signed by the secretary, entitles the holder, to a return trip at one-third the regular fare. Exhibition rooms for specimen brick, models of machinery, etc., will be provided in the hotel free of charge. The programme is as follows:

"The Testing of Clay"—Essay, Edward Orton, Jr., Columbus, O.

"The Soft Mud Process; Its Advantages and Disadvantages"—Essay, John Greusel, Detroit, Mich.

"Paving Brick from the Standpoint of the Engineer and Manufacturer"—Address, Daniel W. Mead, Rockford, Ill.

"Consolidation as a Cure for Demoralizing Competition"—General discussion, led by a member of the New England Brick Manufacturers' Exchange, New Haven, Conn.

"Management of Brick Works"—Address, B. W. Blair, Cincinnati, O.

"Burning Brick"—General discussion, led by L. U. Nickell, Fulton, Mo.

"Brick Making Up to Date"—General discussion, led by a member of the Western Pennsylvania Brick Manufacturers' Exchange, Pittsburg, Pa.

"Drying Brick"—General discussion, led by John F. Seddon, Kansas City, Mo.

"Looking Backward"—General discussion, led by W. D. Gates, Chicago, Ill.

"Danger Signals"—Essay, Robert W. Lyle, Woodbridge, N. J.

"Can Shale Paving Brick Be Toughened by the Annealing Process?"—General discussion, led by Capt. W. S. Williams, Canton, O.

"My Experience in the Manufacture and Laying of Paving Brick"—Essay, J. A. Bucksta , Lincoln, Neb.

"Elements of a Good Paving Brick"—General discussion, led by Commodore W. J. Kountz, Allegheny City, Pa., and D. V. Purington, Chicago, Ill. Illustrated with sample brick.

The question box embraces the following:

"Is shale improved by weathering, or is it better worked direct from bank?"

"What quantity would be considered a fair average of No. 1 face brick from an ordinary continuous kiln, working under fair average conditions as regards fuel and labor?"

"Is it practicable when burning brick with oil to water-smoke with that fuel?"

"Which is the best practical way of preparing shale for high class dry pressed brick?"

"Which is the best way or method of setting shape and ornamental brick in a down draft kiln?"

"Does it pay to carry insurance against brickyard casualties, and what is the cost?"

"Given an almost level tract of land, with very little chance for drainage, and shale the material, what would be the most feasible plan for bringing material into sheds, or to crusher direct, as the case might be?"

"What weight of coal slack or anthracite screenings can be safely used to harden salmon brick by mixing with clay at the time it is pugged?"

"What are the relative advantages or disadvantages of piece and day work in the manufacture of dry press brick?"

"How many of the members use grog, and in what proportion, for molding sand faced, soft or stiff mud brick? What are its special advantages?"

"Does the admixture of sand with shale improve that material for manufacture of paving brick?"

The annual banquet will be held on Tuesday evening, February 12, at the Hollenden.

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The sixteenth annual convention of the Iowa Brick, Tile and Drain-

age Association will be held at Des Moines, Ia., Feb. 6 and 7. The following programme will be rendered:

Annual address by the president, Robert Goodman.

"The preparation and Pugging of Clay and Shale for Stiff Mud Process," W. K. Cook, Des Moines.

"Steam Drying of Clay Goods," L. A. Thorson, Fort Dodge.

"Burning Paving Brick," O. K. Dunhirst, Des Moines.

"Advancement of Paving Brick for Paving Purposes," Mr. Brite, of Flint Brick Company, Des Moines.

"Clay Manufacturing; Its Tendency and Progress; Iowa City Deposits," E. H. Lonsdale, Jefferson City, Mo.

"Preparation of Clay and Shale for Dry Pressed Brick," Alex. Cowan, Gladbrook.

"Burning Clay Ware in Continuous and Down-Draft Kilns," Thomas Green, Sioux City.

"Dry Pressed Brick," Sioux City and Sargent's Bluff Company, Sioux City.

"How to Protect Your Plants from Fire," J. Dixon Doyle, Chicago.

"Two Lessons Most Prominent for Brick and Tile Making in the Past Two Years of Business Depression," J. B. McHose, Boone.

"Some Pointers on Tile and Pipe Manufacture," Mr. Pentland, of Eldora Clay Manufacturing Company, Eldora.

"Drain Tile; Their Field and Progress," J. C. Clark, Keota.

Question box. Treasurer's report. Election of officers. Adjournment.

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The sixteenth annual convention of the Ohio Tile, Brick and Drainage Association will be held in Cleveland, February 12, 13 and 14, in joint session with the National Brick Manufacturers' Association.

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MUNICIPAL REPORTS.

Minneapolis.—City Engineer Cappelen's report gives the total amount of work and expenditures in Minneapolis as follows: Sewers, 123 miles, $3,847,000; water-mains, 221.1, $2,379,249; cedar block, 68.1 miles, $1,177,506; granite block, 9.7 miles, $337,781; asphalt street, 3.4 miles, $155,904; granite curb and gutter, 11.2 miles, $52,304; other natural stone, 78.5 miles, $452,053; artificial stone, 22.2 miles, $124,850.

Work ordered for 1895 is: Sewers, 8.2 miles, $190,558; water-mains, 18.8 miles, $160,176; cedar block, 1.1 mile, $40,192; granite curb and gutter, 2.3 miles, $10,135; artificial stone, 1.8 miles, $6,828.

The annual report of Sewer Engineer Ilstrup, Minneapolis, shows that during the last year the sewer department has constructed 10,556 miles of sewers and sewer tunnels. The estimated cost of the new work was $323,312.14, which amount was appropriated, but the department reduced the actual cost to $270,649.50.

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Denver.—The report of Arthur C. Harris, president of the board of public works at Denver, Colo., shows the total mileage of paved streets in that city to be fourteen miles. The pavements are of asphalt and sandstone, and cost $1,285,218.34. Of Trinidad sheet asphalt on a six-inch concrete base, there is 244,590 square yards. California sheet asphalt on a six-inch concrete base, 61,988 square yards. Sandstone blocks on a six-inch concrete base, 64,576 square yards.

The total miles of sewers in the

city is 172¾, constructed at a cost of $2,074,590.80, making the total cost of pavements and sewers up to date, $3,359,809.14. The character of the street work in Denver is of the highest order, and equaled only by the city of Washington, D. C.

The proposed improvements for 1895 will add greatly to the city's system of municipal improvements.

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Omaha.—The report of the board of public works at Omaha, Neb., for the last year, shows that the city has 76.83 miles of paved streets, as follows: Brick, 10.19 miles; asphalt, 20.38 miles; stone, 23.07 miles; wood, 23.19 miles.

It costs the city about $20,000 per year to sweep and clean the streets. Asphaltic paving is the most popular pavement with teamsters in Omaha, but stone is more durable, and requires the least expense to keep it in repair.

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Manchester, N. H.—The street and park commissioners at Manchester, N. H., have submitted a report of the work done during the last year. At the beginning of the year 119 streets were laid out but not built. These streets aggregate 133,307 feet, or 25.247 miles. More than three miles of streets have been built, some of which were blasted through rock, others built where large bowlders had to be removed, and in West Manchester deep cuts, in some cases seven feet deep, were made. The report says that since the advent of the steam road roller the means of improving the traveled streets has increased, and the only desideratum necessary now is the money to facilitate a great work in the direction of good streets and roads. At the beginning of the year twenty-nine sewers, 8.18 miles, were voted in but not built. The sewers that have been built have been through ledges, necessitating slow work. A Carson trench excavating machine and cableway was purchased which has given valuable aid in the deep sewers.

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Pittsburg.—The reports of the heads of the city departments at Pittsburg, Pa., show the expenses of the last twelve months, together with an estimate of the appropriations needed for the fiscal year beginning February 1, 1895. The total increase in the estimates over the expenses of the last year is more than two millions more than was expended last year.

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Cleveland.—The report of the city director of Cleveland shows an expenditure of more than $5,000,000 in 1893. Only about one-third of this amount was expended for permanent improvements, and about one-half of that was for new pavements. While paving is considered a permanent improvement, the report shows that only one section of the stone pavement, and none of the brick pavements, have been constructed in a manner usually considered permanent. The report says: "While it is undoubtedly true that our pavements compare favorably in some repects with pavements of other cities, I think great improvements could be made in the methods used in the work of construction. There is not enough attention paid to obtaining the best results. Permanence in construction means economy in repairs, and every means should be taken to secure good foundations and proper materials. The appointment of inspectors should be regulated by the ability of the men and their knowledge of the charac-

ter of the work and methods to be used, and political influence should be utterly disregarded.

"The methods employed in the maintenance of our streets are being improved. Efforts are being made to change the character of our street department from its condition of a 'rest for the infirm,' as the report of the department of public works states, and the result has been to place it upon a business-like basis. Certain reforms have been made, and more will come. Our streets, however, are at no time clean, and the mud upon our pavements should be kept down. Yet the principal reason for their being in such a condition is the fact that from all sides there are dirt roads entering the city, intersecting our paved streets, and depositing, through the medium of hoofs and wheels, their mud and dirt upon our pavements. We have only 18 per cent. of our streets paved, and the other 82 per cent. are assisting in the defilement of our pavements. In 1893 the street department expended over $138,000 in material and labor for repairs to street pavements, sewers, drains, catchbasins and cleaning the streets, sewers and catchbasins. The cleaning, rounding and filling of unpaved streets cost the city over $52,000, and this appears to be a waste of money. After the first heavy storm the surface of these streets was deposited upon the adjoining pavements. Three hundred dollars per mile per year for cleaning the paved streets does not seem like a waste of money, but when a street becomes immediately in the same or worse condition, we feel impressed by the uselessness of the work. There is a remedy which our city must apply, and that is to proceed at once to make such permanent improvements, in the way of draining and paving, that before long our whole city will be in such a condition that dirt upon our pavements will be unknown. Let us see what such a move involves. Until a street is to be paved the old sewers are usually considered sufficient, consequently when new pavements are put in a new sewer has usually to be built. Last year (1893) there were built 13.986 miles of sewers of various kinds, at a total cost of $317,272.40, or an average cost per mile of about $22,700. There were paved 18.67 miles of streets, or an average cost of about $46,006. The average cost, therefore, of draining and paving the streets of this city is $69,300, or say $40,000 per mile. There are about 400 miles of unpaved streets, which, if paved and improved would give this city an advantage over many cities in appearance and in healthfulness.

"Four hundred miles at $40,000 per mile would be $28,000,000. If we should keep up our present rate we should accomplish this result in about twenty-five years, if it were not for the fact that a part of our work each year is repaving. There is where we lose money by our economy in first cost and our old-fashioned methods. It costs Buffalo 80 cents more per square yard for stone pavement laid on concrete than it costs us for stone pavement on sand; that is 30 per cent. There can be no doubt in the minds of any one as to the superior advantage of a pavement with a foundation over one without. These advantages are as follows: The concrete is calculated to so distribute the loads and weights of the pavement as to prevent unequal settlement, and is practically the same thing as a single band of solid rock upon which to support the surface. The two

inches of sand acts as a leveler and cushion, preventing the inequalities in the upper surface of the concrete from being felt in laying the stone, and preventing the blows from heavy traffic of the street from being too suddenly communicated to the concrete. The pitch which fills the joints prevents water from penetrating to the foundation where it would freeze and heave the stone irregularly and at the same time damage the foundation. With this kind of pavement it is essential that the engineer shall have sufficient foresight to enable him to put in absolutely all the pipes and curb connections needed, for it is practically impossible to replace a pavement of this sort and make it as good as at first. The wearing surface of this pavement will last better than our present ones, will retain its form and evenness, and when it requires changing can be taken up without disturbing the concrete and new pavement can be laid at a less expense than it costs us to repave." —

Syracuse.—Great progress has been made in public improvements during the year 1894 at Syracuse, N. Y. A summary of the street work for the year shows the following: Sewers, 8 miles, $115,799.67; pavements, 5.4 miles, $115,799.67; grading, $60,488.49; sidewalks, $10,377.49; sprinkling, $8,731.55; miscellaneous, $46,228.32. Total, $603,318.49.

Contracts for eleven miles of pavement have been made for this year, at a cost of $859,000.

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St. Paul.—During the last seven years, St. Paul, Minn., has expended $7,539,789 in pavements, sewers, water mains, bridges and other public works. Of this sum $17,581 was for brick and asphaltic pavements laid during 1894, and $30,663.56 for sewers. The asphaltic paving, which brought forth much argument in the city prior to a trial of it, has proved eminently successful in the practical test given it in a district where heavy draying is done, while the block of vitrified brick paving, on Summit avenue in the steep 7 per cent. grade, solves the question of a suitable pavement for grades too steep for asphalt, and for a permanent and smoother pavement than granite. —

Jacksonville, Fla. — The total amount of paving constructed at Jacksonville, Fla., during the last year, was a little more than five miles. Contracts have been awarded for paving ten miles more of streets, as follows: Brick, four miles; Alachua rock, four miles; Black creek marl, three and one-half miles. Many miles of sidewalk, wood, brick and stone, have also been laid. —

Milwaukee.—The record of the board of public works for 1894, at Milwaukee, Wis., shows nine miles of new pavement and twenty miles of sewers. On the east side and in the west division A there were laid 64,298.56 square yards of asphalt, at a cost of $151,615.49. All of the different materials used in paving during the year shows an area of 9.196 miles, at a total cost of $371,711.69. While other seasons have shown a greater amount of paving than that done last year, the changes have never before been so striking, to even the casual observer, as it has been during the last season. The improvements will be continued this year quite as extensively as last year. Asphalt was tried for the first time last summer and with satisfactory results. This year the laying of asphalt will be continued, and the board will recommend vitrified brick for a number of streets,

as a test of its qualities. The three materials mostly favored in Milwaukee now cost per yard on an average, as follows: Brick, $2.25; asphalt, $2.30; cedar block, $1.25. Milwaukee has an aggregate mileage of 276.876 of sewers built at a cost of $3,932,878.19.

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Saginaw, Mich.—Mr. Udo Hesse, assistant city engineer, sends to PAVING AND MUNICIPAL ENGINEERING a summary of public work done in Saginaw during the season of 1894. There were 4.05 miles of streets paved and repaved, requiring 102,586 square yards of paving as follows: 44,976 square yards cedar on 6-inch concrete foundation, 38,408 square yards cedar on board foundation, 910 square yards stone block paving, 11,920 square yards macadam, 6,372 square yards Telford. Total number of square yards, 102,586. Total cost, $124,086.31. There were 6,330.5 feet of pipe sewers constructed and 3,690.4 feet of brick sewers at a total cost of $20,674.59.

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Portland.—Portland, Ore., has 171.5 miles of improved roadway, 438.8 miles of sidewalks, and 38.4 miles of crosswalks. The sewerage system of the city consists of 10.06 miles of brick and stone sewers, ranging in diameter from 26 to 90 inches, and 75.13 miles of pipe sewers varying from 8 to 24 inches.

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Albany.—City Engineer Andrews, at Albany, N. Y., reports that the city has an area of 10.73 square miles, 61 miles of streets, and 65 miles of sewers. During the past year 21 laws were passed by the common council for contract work, and the work authorized has been completed at a cost of $47,373.93. Very little progress was made in the repaving of streets; 7,000 square yards of cobblestones were removed, however. Nearly 49 per cent. of the entire area of city pavements is still composed of cobblestones. A brick pavement was laid on Quail street south of Madison avenue. It was the first of the kind laid in Albany.

An amendment to the charter is suggested allowing the common council and the board of contract and apportionment to recommend the use of brick for repaving cobblestone streets where that material is considered more suitable than asphalt or granite block.

Nearly 3,000 feet of old sewers were replaced with new, and an equal length of house drains was completed.

Mr. Andrews recommends the construction of several trunk sewers, which, in his opinion, are more immediately needed than an intercepting sewer.

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Atlanta.—At Atlanta, Ga., there has been laid during the last year 3.6 miles of granite paving at a total cost of $61,854.17, making 59 miles of paved streets in the city. There was also laid during the year 9.27 miles of brick sidewalks, making a total of 182.19 miles of brick sidewalks in the city.

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Brooklyn.—Alfred T. White, city works commissioners of Brooklyn, reports that during 1894 $595,450 was expended in the construction of granite pavements. The city now has 32 miles of Belgian block paving; 87 miles of granite; 272 miles of cobblestone, and 15 miles of asphalt. He estimates the average cost of new pavements of the various descriptions for a roadway ten yards wide between curbs is approximately for each mile of street, on granite, $36,000; on new Belgian, block, $27,000; on cobblestone, $9,000 and on asphalt over cobble-

stones, $40,000, not including curbs, which add, say, $7,000 per street mile to the cost of each. Street cleaning in Brooklyn costs $555,000 a year for 380 miles, which Mr. White believes to be a greater mileage of this kind of work than in New York.

Indianapolis.—The report of the board of public works of Indianapolis, Ind., shows the total expenditure for public improvements for 1894 to have been $1,181,150.15. Pavements and sewers have the following showing: Asphalt, 3.99 miles, $229,744.73; brick, 4 miles, $158,942.73; cedar block, .53 mile, $35,733.64; main sewers, 12.81 miles, $566,394.49; local sewers, 7.21 miles, $66,936.20.

COST OF MUNICIPAL LIGHTING.

H. W. Scott, chairman of the executive committee of the committee of one hundred, at Portland, Ore., gives in his report the cost of lighting some of the northwestern cities, as follows:

CITIES.	Population.	Annual Cost.	Cost Per Capita
Omaha	175,000	$47,600 00	$0 33
Kansas City	132,000	70,403 78	0 5333
Seattle	45,000	38,883 99	0 8640
Detroit	206,000	164,843 92	0 80
Portland	65,000	75.789 85	1 1589
Tacoma	40.000	33.600 00	0 84
Oakland	60,000	60,000 00	1 00
Los Angeles	70,000	65,000 00	0 9142
Spokane	25,000	19.296 00	0 7748

EFFECT OF SALT ON BRICK.

As to whether salt will injure brick Mr. D. V. Purington, of Chicago, says it never occurred to him to test the action of salt on brick, but he doubts if it can be injurious, even if the quality be such that it will absorb more than two per cent. of moisture. "I am prepared to stake my reputation on the statement that my brick will not be injured by salt," he said. "I will at once begin tests, however, to see just what the effect of salt is on all kinds of brick." Later Mr. Purington submitted to chemists an analysis of Galesburg shale, from which is made the brick of the Purington Paving Brick Co. In reply Mr. Purington received the following:

"Your communication containing analysis of the Galesburg clay or shale received. Referring to your inquiry as to the effect chemically of salt (Na Cl) on vitrified brick made from such shale, we would say we find no properties in said analysis, which, when vitrified into brick form, could be attacked by the chlorine contained in salt."

NEW JERSEY'S ROAD IMPROVEMENT ASSOCIATION.

The State Road Association of New Jersey will ask an increase of the State appropriation, from $75,000 to $150,000, so that all the counties may derive some benefit from the fund. Counties along the ocean desire a change in the law that will allow them to use gravel, shell and other substances. While it is thought that the law may be widened to allow the use of other materials, under certain conditions, it is thought that after a trial, satisfaction will be felt with crushed stone only. It is the cheapest material that can be used for the roads. It would require an immense quantity of gravel to pack it down compactly to a depth of six inches.

OHIO AND INDIANA IMPROVEMENT BONDS.

The assistant city engineer of St. Paul, Minn., who has made recent visits to different cities in search of information relating to the work of his department, in his report refers to assessment by installments as follows: "Both in Ohio and Indiana they have an excellent law

that keeps property-owners from feeling the burden of improvements for which they are assessed. This law, which is called in Ohio the Taylor law, and in Indiana the Barrett law, makes it optional for the property-owner to pay his assessments in ten yearly installments. The deferred payments bear interest at 6 per cent. per annum. To pay the contractor, the city is permitted to issue bonds, which are a lien on the assessed property."

THE INDIANA ENGINEERING SOCIETY.

The Indiana Engineering Society met at Indianapolis January 9, 1895. President C. G. H. Goss, in his annual address, stated that 1894 had been a good year for the selling of municipal securities and the building of light plants and sewer systems. The demand for engineering work in Indiana is limited, but the speaker believed that the demand will increase with the development of the state, and that there will always be a demand for skilled work in engineering.

The members of the association discussed the qualifications of candidates for the office of county surveyor, and many favored a license similar to the license required of a teacher before he can teach school. One member stated that a candidate in one county in Indiana had been elected county surveyor who did not know a transit from a level, and who did not know which end to have looked into if he had. This member of the convention stated that he had done this county surveyor's work for three years himself.

A committee consisting of James F. O'Brien, L. S. Alter and Thomas Huckstep was elected and will be known as the legislative committee, whose duty it shall be to consider questions relating to legislation on drainage and road laws for the benefit of the people.

INDIANA HIGHWAY IMPROVEMENT ASSOCIATION.

At the meeting of the Indiana Highway Improvement Association, January 9, Judge P. S. Kennedy, of Crawfordsville, Ind., discussed needed legislation for bettering country roads, in which he favored the letting of contracts for all improvements to responsible persons who should be required to give bond. Gen. Roy Stone, of the United States Road Inquiry, advised the appointment, in Indiana, of a state highway commission. In telling of the progress of the good roads movement in other states, Gen. Stone said that "there are three states in which good provision is now made for highway improvement, New Jersey, North Carolina and Kentucky."

BUFFALO'S NEW ENGINEERING SOCIETY.

The Engineering Society of Western New York was organized at Buffalo on January 9. It will establish permanent headquarters in Buffalo and will endeavor to form a good technical library. The officers are: President George E. Mann; vice-president, E. B. Guthrie; junior vice-president, Walter McColloh; secretary and treasurer, George R. Sikes; directors, George B. Burbank, C. M. Morse. The officers and directors constitute an executive committee.

PROGRESS OF HIGHWAY IMPROVEMENT IN MASSACHUSETTS.

The interest manifested in the hearings given by the Massachusetts State Highway Commission proves that the state road question is an earnest one. A hearing was

given at Northampton in December which brought together about 100 men, representing every town in the county. W. E. McClintock reviewed the work accomplished in Hampshire county, saying that of 121 petitions for state roads, 36 had been accepted and about 500 miles of road had been built. Regarding the sidewalk question, the commissioners believe that when a state road is built, if a sidewalk is needed it should be constructed by the towns themselves. Several stone crushing plants have been established in different sections of the state to facilitate the work of obtaining road material.

DETROIT'S STREET PAVING BONDS.

The paving contractors of Detroit, Mich., are endeavoring to influence the legislature to change the paving assessment law. The law says that property-owners assessed can pay in four annual installments. When paving work of this kind is done, the city gives the contractor one, two, three, and four-year four per cent. bonds, which are supposed to be redeemed by the city when the assessments are collected, but, as property-owners sometimes default on their assessments, the contractors can not get their interest until it is collected with the assessments, and because of the short time for which the bonds are issued they can sell them only at a discount. The contractors want the legislature to make the law enforcing the collection of such assessments a great deal stronger than it is now, and to make the life of the bonds ten years, with six per cent. interest, with the option of paying them any time before falling due. In this way the bonds could be readily negotiated. The contractors in the movement hold $50,000 of the bonds.

ASPHALTIC PAVEMENTS DAMAGED BY STEAM.

A number of instances have been reported to Mayor Van Horn, Denver, Colo., of recently paved alleys being greatly damaged by steam escaping from boiler-rooms and dripping in the form of water upon the asphalt pavements and wearing holes in them. The officials have been nonplused for a remedy until recently, when Mayor Van Horn discovered the existence of an ordinance compelling all property-owners to connect their waste water by pipes with the public sewer.

COMPLAINT OF GRANITE PAVERS IN CINCINNATI.

The granite pavers at Cincinnati, O., have decided to work no longer under sub-contractors. The large contractors, when awarded a large contract, sub-lets it to a smaller contractor. In order to make a profit the sub-contractor is compelled to work the men to their fullest capacity, and of late it is claimed that there is a disposition on the part of the sub-contractors to cut wages and lengthen the hours of work. The regular wages paid a granite paver is $5 per day. At a meeting held January 6, a unanimous vote was taken condemning the system and agreeing to not work hereafter under the sub-contractors.

SPECIFICATIONS FOR BRICK PAVEMENTS IN LOUISVILLE.

Recent ordinances passed at Louisville, Ky., for brick paving set forth specifications as follows:

"The street surface shall be worked to grade, and the crown of the sub-grade shall be twelve inches below the top of the curbing when set to grade.

"After being thoroughly rolled and cleaned and the material approved, a six-inch bed of hydraulic

cement concrete shall be laid. The formula for the cement is: One measure of cement and two of clean, sharp sand, thoroughly mixed dry, and then made into mortar with the least possible amount of water; broken stone or hard brick cleaned, drenched with water, but containing no loose water in the heap, to be incorporated with the mortar so as to give a surplus of mortar. This mixture is to be spread and rammed. On the foundation thus prepared a bed of clean, sharp sand shall be spread two inches deep, and upon this bed the paving brick is to be laid, on edge, at right angles with the street, except at street intersections, where the board of public works may make special orders. Brick must be laid as compactly together as possible, and all joints are to be broken by a lap of at least two inches. Brick must be hard burned, for paving especially, of uniform size and free from flaws. Nothing less than half a brick may be used to break joints. The brick must be burned throughout to vitrification. When the brick has been laid for a distance of sixty feet, the first fifty feet must be covered with clean, sharp, dry sand, which must be swept in and the whole pavement rolled or rammed to the true section. After the rolling and ramming is completed, the joints shall be filled with paving cement, obtained from the residuum of distillation of asphalt or coal tar. Then the whole should be covered with half an inch of sand.

"Footway crossings are built three inches higher than the street. When a street railway track is laid in the street, the rails, ties and stringers shall be put in place by the company before the paving is laid, or if afterwards at the expense of the company, as shown in the engravings. Street intersections and curves shall be laid as shown in the plan. A granite liner between the brick and the rail is provided. The space between the track and directly outside is to be filled with concrete."

A NOVEL EXPERIMENT IN FOUNDATIONS.

A novel experiment is being made at Martha's Vineyard, by the Massachusetts Highway Commission. In macadamizing the roads at that place it has been found that the ballast stone would not stay in position in the sandy foundations, for the sand constantly worked to the top, while the stones were lost in the depths of the sand. Gravel was tried for a foundation, with fairly good success, but it was costly and scarce. Cheap cotton cloth was then tried with good results, as it seems, apparently, to be the material needed. It is found that the sand does not work up through the stone, and that much less stone is required. Layers of tarred paper were tried before the cloth, but it was found that the stone pressed through it. A small section only of the road has been experimented upon, thus far, but if it continues to be as successful as at present the experiment will be carried still further.

THE DEPARTMENT OF PUBLIC WORKS IN A GREAT CITY.

Mr. Alfred T. White, of Brooklyn, N. Y., delivered an address, January 16, before the Manufacturers' Club, at Philadelphia, on "The Department of Public Works in a Great City." This is one of a series of lectures on municipal problems that is being given before the Wharton School of Finance and Economy of the University of Pennsylvania. Mr. White is prominently identified with the reform movement in Brooklyn.

Philadelphia and Brooklyn, Mr. White said, include more subjects in the care of their department of public works than any other cities. In New York the growth of the city has compelled a division of the department of public works. Perhaps the type of the greatest scattering of responsibility was in Boston, where it is shared by eight or nine boards. In a good many cities the boards of public works are retained. In some cases good results have been derived from this system, notably in Buffalo, where there existed a somewhat peculiar board of three. In Buffalo they have just elected as mayor the former director of public works. A different system prevails in St. Louis, which is much commended. In the latter city the president of the board was elected and the mayor appointed five commissioners, to each of whom was confided the care of executive bureaus, making a board which initiated all public works. This board not only proposed all new works, but also made the plans. The execution of them, however, devolved on the one commissioner at the head of the department. This board of experts also framed all the ordinances for public works. This was a plan that is a favorite one with engineers. In Brooklyn, however, they are wedded to the single-head idea.

Power of removal of the higher officials in the department of public works is checked in every large city.

In the matter of appointing subordinates, the charter of Brooklyn gave to the head of the department absolute control—except in those cases where the civil service laws applied. The head of the department, however, could, within a month after taking office, remove at will even civil service appointees. After the expiration of that time, however, he must give reasons for any removal.

Regarding the satisfactory results of examinations for an upper engineer, and an assistant engineer, Mr. White said: "In the latter case, more than one hundred applicants responded to an advertisement; seventy-four were examined, and he had been shown, for the first time, a list of forty-four names of those who had passed. The first twenty of these were, in every instance, graduates of technical schools, and formed a great deal of tip-top material which he could never have gotten except in that way. Massachusetts is the only state that has a system of enlisting employes under civil service."

In relating the workings of his own department, Mr. White said: "In the matter of street repairs, the expenditure was under the absolute control of the commissioner of public works. Last year the legislature passed an act that only American citizens should be employed in such work. In Brooklyn 380 miles of streets were cleaned to the fair satisfaction of the people, for $350,000.

"The contract system by which this was done was more satisfactory than if the city did the work. The city could only work the men eight hours a day, whereas they worked ten hours for the contractor, and the latter paid them 12½ cents an hour, while the city paid 18¾ cents. Hence the department did all the work it could by contract. The contract system is going to remain the best process for some years. The men who work for the city do not expect the city to work them so hard as do the contractors."

LEGAL DECISIONS.

[Reported especially for PAVING AND MUNICIPAL ENGINEERING.]

Procedure for Assessments for Street Improvements.—Under Sec. 2270, Rev. St., the value of the lot or land, with the improvements, as assessed for taxation, is to be taken in determining the limit to which it may be assessed for the improvement of a street on which it abuts, whether made by the foot front or otherwise. Section 2269 applies to an assessment by the front foot only, where land bounding or abutting on the improvement is not subdivided into lots; and its object is not to fix the depth of lots for the purpose of varying the amount of the assessment, but a depth beyond which its lien can not in such cases attach. Where a street is of different widths, it may, in a proceeding to improve it, be divided into as many sections as there are different widths, and the property on each section assessed for the cost of the same. Findlay *v.* Frey (Supreme Court of Ohio), 38 N. E. Rep. 114.

Liability of Municipal Corporations for Sewer Contract.—A city is not liable on a contract for the construction of a sewer where no provision is made at the time of its execution for payments thereunder, as required by Const., Art. 11, Sec. 5, and it does not appear that the revenues of the city for that fiscal year are in excess of its ordinary expenses. Kuhls *v.* City of Laredo (Court of Civil Appeals of Texas), 27 S. W. Rep. 791.

Action by Material Man on Bond of City Contractor.—A person furnishing materials to one under contract with a city to build a sewer, and within ninety days after its completion to pay all sums of money due at its completion for materials used on said work, can not sue on the bond given by the contractor for the faithful performance of his contract with the city, unless the bond was made for the direct and primary benefit of such material man. Parker *v.* Jeffery (Supreme Court of Oregon), 37 Pac. Rep. 712.

Liability of City for Change of Street Grade.—Under a provision of the constitution which provides that private property shall not be taken or "damaged" for public use without compensation, the owner of a lot on a street which was dedicated to the city may recover for damages caused by the grading of the street to the established grade. Evidence of the diminution in the value of the lot by the adoption of the ordinance establishing such grade is inadmissible, as there can be a recovery only for the actual physical change of grade. Benefits to the lot from the operation of a street railway on the street after it was graded can not be considered to diminish the damages. Eachus *v.* Los Angeles Consolidated Electric Ry. Co. (Supreme Court of Cal.), 37 Pac. Rep. 750.

LETTERS FOR THE PUBLIC.

CHEMICAL TESTS OF ASPHALT.

To the Editor of Paving and Municipal Engineering.

With reference to the subject of extraction of petroline from asphalt, I have long experienced the unsatisfactory nature of this most useful form of comparison of asphalts by the ununiformity of the solvents used. Even if we use only petroleum naphtha the amount of bitumen dissolved depends on the

maximum boiling point or specific gravity of the solvent. This I have proved by a most interesting series of experiments which point out clearly: (1) The looseness of the term petroline. (2) That the amount of bitumen, so-called petroline, dissolved by petroleum ether increases with the limiting boiling point of solvent, and (3) that in view of this results are of little value for comparison except the naphtha used as solvent be most particularly defined.

A standard solvent is highly desirable, and as I know of no previous attempt to establish this, I shall hereafter use in my laboratory naphtha distilled over between 60° and 80° C. for the extraction of petroline, unless a more advantageous standard is soon proposed.

As yet the high tensile strength tests published by Capt. Torrey have not been obtained in this laboratory under any circumstances. I now use specially prepared briquettes of brass (being cast on the same pattern as an ordinary Portland cement briquette) having a one inch square section. Capt. Torrey says his "specially devised apparatus" exposes a one-eighth square inch section to the strain. I fail to see how he dare hope to get accurate scientific results with such a small section. The time of application of stress in my case is about thirty seconds for 450 yards.

Frank N. Speller, B. A. Sc.

Toronto, Jan. 4.

FORMULAS FOR CALCULATING STREET RAILWAY CURVES.

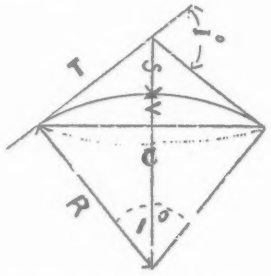
To the Editor of Paving and Municipal Engineering:

Last month I surveyed, for the Hannibal Railway Company, nearly two miles as an extension of their electric railway to Indian Mound Park, near Fry Town, just outside of the city of Hannibal, Mo.

The company is nearly through grading, and will commence laying ties and iron soon. The company purchased their steel rails at Chicago for twenty-four dollars per ton delivered.

I send you a few formulas for calculating street railway curves:

Let R=Radius.
" T=Tangent.
" S=External secant.
" V=Versed sine.
" C=Chord.
" I°=Angle of deflection.
" g=Gauge of track.
" n=3.1416.



Then $T = R \tan. \frac{1}{2} I° = S \operatorname{Cot}. \frac{1}{4} I°$

$$R = \frac{T}{\text{Tan. } \frac{1}{2} I°} = T \operatorname{Cot}. \tfrac{1}{2} I° = S \operatorname{Cot}. \tfrac{1}{4} I° \operatorname{Cot}.$$

$$\tfrac{1}{4} I° = \frac{C}{2 \text{ Sin. } \frac{1}{2} I°}$$

$$S = \frac{T}{\operatorname{Cot}. \frac{1}{2} I°} = R \tan. \tfrac{1}{2} I° \tan. \tfrac{1}{4} I° = \frac{R}{\text{Cos. } \frac{1}{2} I°} - R$$

$V = R (1 - \text{Cos. } \frac{1}{2} I°) = R - R \text{ Cos. } \frac{1}{2} I°$

$C = 2 R \text{ Sin. } \frac{1}{2} I°$

To find length of inside rail for making patterns, etc.:

$(2R - g)$ Log. = +
n " = +
I° " = +
360° " = −

=Log. inside rail=its length, etc.

F. R. Lockling, C. E.

EFFECT OF FREEZING WEATHER ON CEMENT MORTAR AND CONCRETE.

To the Editor of Paving and Municipal Engineering:

The Michigan Engineering Society has appointed a committee to

collect information regarding the effect of cold and freezing weather on cement mortar and concrete. The following questions indicate what we are after. The material and air are supposed to be at the same temperature. What temperature gives the best result in cement mortar and concrete mixing? Is cement mortar made at 40° F. injured? Is cement mortar made at 32° F. injured? Is cement mortar made at 25° F. injured?

D. Skeels,
Member of Committee.
Grand Rapids, Mich., Jan. 18.

LONDON'S INTERNATIONAL BUILDING EXHIBITION.

To the Editor of Paving and Municipal Engineering:

One of the sections we are taking up in our International Building Exhibition to be held next March in London is that of Paving, and as such no doubt will be of interest to your readers, I am pleased to say that a large amount of space has already been allotted, so that the success of the exhibition is assured.

I am acting as agent for the American and foreign sections and shall be very glad to answer any inquiries or give any information or assist in any way possible, if any of your readers desire to take a hand and exhibit at this exhibition. I need hardly point out that it will be a splendid chance for any one wishing to introduce any specialty to the British building trade at a minimum of expense.

George W. Callender.
London, 222 Strand.

MACHINERY AND TRADE.

A MODEL PAVING BRICK PLANT.

One of the model paving-brick plants is that of the Purington Company at Galesburg, Ill., where inexhaustible deposits of pure shale are available. The shale is excavated by means of two powerful steam shovels and is carried from the banks to the works by cable cars, dumped into steam crushers, then pulverized to a fine powder under heavy revolving rollers. This is then screened in order to extract such small particles of quartz as the shale might contain. The material is then moistened and thoroughly mixed and tempered, after which it is carried through presses, from which the green material comes out in brick size of continuous length and is cut to the regulation length by automatic cutters. The green bricks that go under sixty fan-repressing machines of which the Purington Company has four. The brick is then ready for the driers where, by a slow heat, about ten per cent. of the moisture is extracted before placing them in the kilns. These kilns are fired to a white heat by the use of oil and steam injected through openings.

After remaining some seventy hours subjected to this continuous fire, the bricks are allowed to cool off and are ready for the market—a repressed shale brick, thoroughly vitrified from surface to center and nothing short of an emory wheel could make an impression upon them. The Purington Company turns out between 80,000 and 100,000 a day of re-pressed paving bricks. It was the Purington Company that laid at its own expense the brick pavement, as an object lesson for the people of Chicago,

on LaSalle street, between Madison and Washington streets. Though the bricks now made by this company are all re-pressed, at that time they had not added re-pressing machines to their plant.

RECENT INVENTIONS.

[Reported specially for PAVING AND MUNICIPAL ENGINEERING by Chandlee & Chandlee, Washington, D. C.]

530,337. *Self-Recording Canal, Sewer, and Rain Gauge or Meter.* Alva J. Grover, Omaha, Neb. Filed Dec. 15, 1893. Serial No. 493,721. Claim. — A self-recording sewer gauge comprising a float pivoted by an arm to the sewer, a wheel upon said float, a circuit breaker consisting of a revolving key, mechanism between said wheel and key for revolving the same, mechanism between the float and key for periodically lifting the key as it revolves, a contact device operated by said key as it lifts, a chronographic drum and a magnetically operated pen in contact with said drum, whereby as the circuit is broken the said pen may record a curve upon the drum, from which the depth of sewage and the velocity of current are obtained.

530,077. *Pavement of Plastic Composition.* Joseph H. Amies, Philadelphia, Pa., assignor to the Amies Pavement Company, Camden, N. J. Filed May 8, 1893. Serial No. 473,431. A plastic pavement composed of vegetable fibers saturated with a composition of soft-pitch, kidney-oil, and rosin, and filled with powdered peat, cement, and mineral matter ground fine, the whole being compacted together under suitable pressure.

530,887. *Street-Box for Gas or Water Pipes.* Frederick A. W. Davis, Indianapolis, Ind., assignor to Elizabeth K. Davis, same place. Filed March 23, 1894. Serial No. 504,786. The combination, in a street-box for gas or water pipes, with the box proper having an annular flange and a projection or lug of the cap having a central tubular projection with a T-shape slot therein, and also provided with an annular flange surrounding the flange when in place, the lines of division between the cap and the upper end of the box on which it rests being substantially horizontal.

530,816. *Manhole for Sewers.* George Wright, Winnipeg, Canada. Filed May 11, 1894. Serial No. 510,888. The combination with the open-ended metal casing or lining for manholes formed near its upper end with an offset, and a second offset thereabove, the upper horizontal wall or flange of which is provided with slots in its inner edge, of the open work cover resting on said flange and having radial pins passed down through slots and engaging the under side of said flange, and the mud pan of less diameter than the casing and having radial pins resting on the shoulder formed by the offset.

530,622. *Treatment of Sewage and Apparatus Therefor.* William D. Scott-Moncrieff, London, England. Filed November 21, 1892. Serial No. 452,698. Patented in England August 22, 1891, No. 14,-181. A method of purifying sewage which consists in passing the sewage, without previous removal of the solid portions, under a suitable head, first through a concentrating chamber with contracted outlet openings in which the solid portions are retained until so far decomposed by the action of the micro-organisms that they can pass through the outlet openings, while the life products of the micro-organisms are allowed to pass out with the liquid and finer solid particles without delay, and then up-

ward through a filter bed of suitable depth and of greater superficial area than said concentrating chamber, whereby the decomposition of the solid matter is substantially completed.

TRADE NOTES.

Cement works are being erected at Phillipsburg, Pa.

A new brick plant will be established at Mt. Sterling, Mo.

A new asphalt paving company is to be organized at Syracuse, N. Y.

The plant of the Granite Pressed Brick Co., Woonsocket, R. I., will be improved.

The sewer pipe factory of Wells & Reichert, Appleton, Wis., is about completed.

Articles of incorporation have been filed by the Mobile Paving Company, at Mobile, Ala.

The Colorado Paving Co. will erect an asphalt plant at Houston, Tex., at a cost of $35,000.

Wayne & Von Kolnitz, Charleston, S. C., are soliciting prices on brick and tile machinery.

A new brick company has been organized at Vanceburg, Ky., and a plant will be established.

The Oregon Vitrified Brick Company, Vancouver, Wash., has gone into the hands of a receiver.

A brick and tile factory will be started this spring, at Elizabethton, Tenn., by Edens & Croy.

Action will be taken at Riverside, Cal., in ascertaining the cost of a rock crusher and power to run it.

A brick plant will probably be established at Centerville, Ia., by Alexander Mordis, of Corydon.

The city engineer, at Fitchburg, Mass., has recommended the purchase of a portable stone crusher.

The High Springs Brick Company, High Springs, Fla., contemplates the purchase of brick machinery.

The Owensboro Brick and Sewer Pipe Company, Owensboro, Ky., wants prices on brick and tile machinery.

The Fruin-Bambrick Construction Company has been organized in Syracuse, N. Y., with Thomas Merriam at its head.

The purchase of a rock crusher is favored at Merrill, Wis., where the question of macadamizing the streets is being considered.

The price of Bedford sandstone has been advanced to 20 cents a cubic foot by the stone companies in the region of Bedford, Ind.

The Houghton Brick Co., Carthage, N. Y., contemplates putting in new tile machinery and making a specialty of tile in the future.

A brick plant, for the manufacture of paving and pressed brick, and red and buff building brick, will be established at Perry, Iowa.

A resolution was defeated recently, at Marion, Ohio, for purchasing the street sweeper now in possession of the street commissioner.

The Houston Pressed Brick and Tile Company, Houston, Tex., is in the market for brick kilns, and a mixer for clay used with dry press machine.

The machinery and the plans for the main building and drier for the Catskill Shale Brick Company, Catskill, N. Y., were all furnished by J. W. Penfield & Son, Willoughby, O.

The Empire Portland Cement Company, at Warners, N. Y., is making extensive improvements.

A company of Des Moines capitalists is being formed to develop the red rock quarries in Jasper county, twenty-eight miles east of Des Moines.

The Milwaukee Cement Company, Milwaukee, Wis., has purchased the plant of the Cream City Cement Company, at Humboldt, Minn.

L. L. Stephenson & Co., brick manufacturers at Elberton, Ga., contemplate the addition of new machinery to their establishment in the spring.

A fine quality of fire-clay has been found in large quantities near Flushing, Mich., and Saginaw owners contemplate the erection of a $25,000 plant.

New machinery will be purchased and sundry other improvements will be made in the spring by Collinge Bros., brick manufacturers at Zumbrota, Minn.

Marl has been discovered in the Beaver meadows, about two miles south of Le Roy, N. Y., and tests are being made by the Retsof Salt Mining Company.

An electric carriage has been invented at Kansas City, Mo., which has a speed of eleven miles an hour. It is the only invention of the kind in the United States.

New York parties are interested in the asphaltum beds near St. Jo, Tex., and a company has been formed to erect a $50,000 plant and develop the material. The officers and directors are: President, R. F. Sampson; treasurer, J. D. Evans, of St. Jo; directors, T. J. Owens, of St. Jo, and S. B. Hanway, of Dallas.

The Thompson & Gray Quarry Company, St. Charles, Mo., has been incorporated with a capital stock of $10,000, by J. W. Thompson, John Gray and others.

The purchase of a steam road roller, to weigh not less than 12½ gross tons, has been recommended by the conference committee of councils, at Allentown, Pa.

Chambers Bros. Company, Philadelphia, Pa., will bring out several new machines during 1895, including a re-press, machine for side-cut brick, and a pug-mill.

An extensive trap-rock stone quarry, near Hertzogs Mill, Berks county, Pa., has been leased by Philadelphia capitalists. The product will be shipped to Philadelphia.

The Consolidated Asphalt Co. has leased asphalt lands near Russellville, Ky., for $100,000, for the purpose of developing it. Two years ago the ground was worth but $500.

The Paeltz stone quarry, at Otway, O., has been purchased by James E. Pancoe, of Cincinnati, and William Herford, of Catlettsburg, who represent a Cincinnati syndicate.

Hon. E. B. Bulkley, O. G. Devendorf and David H. Rogers are organizing a stock company for the manufacture of brick from a clay that has been discovered at Antwerp, N. J.

All of the available brick in Toledo, O., have been purchased by John R. Boice, who now controls more than 18,000,000. The brick were purchased at $4.50 per thousand, and January 1, Mr. Boice advanced the price to $6.50 per thousand.

The National Asphalt and Roofing Company has been incorporated at East St. Louis, Ill., by Chas. W. S. Cobb, Hobart Brinesmade, Jas. B. Johnson and Frank W. Terpening.

The first steam plant for making brick ever sold in Cuba has just been placed by the Frey-Sheckler Co., of Bucyrus, O., who sold a complete outfit of machinery, including represses.

The Geneva Washed Gravel Company has been incorporated at Geneva, Ill., by H. B. Bartholomew and Thomas Snow, of Batavia, and B. W. Dodson, of Geneva. Capital stock, $25,000.

The Saginaw Clay Manufacturing Company has been organized at Saginaw, Mich., with the following officers: President, John H. Qualman; secretary, R. W. Roberts; treasurer, Isaac Bearinger.

The Purington Brick Co., Chicago, Ill., has been reorganized, with T. S. Dobbins as president and E. S. Cosgrove, secretary. The company will not handle pressed brick hereafter, but make common brick exclusively.

A foundry building has been added to the plant of the Decatur Leader Manufacturing Company, Decatur, Ill. This company has made recent sales of brick machinery at Franklin, La., St. Anne, Ill., and Hawarden, Ia.

The Abingdon Paving Brick and Tile Co., Abingdon, Ill., met Dec. 14, and elected officers and directors for the ensuing year, as follows: President, W. H. Reynolds; manager, Charles Peister; secretary-treasurer, Orion Latimer; directors, W. H. Reynolds, Charles Peister, J. B. Scheitlin, Orion Latimer and J. L. Manker. A dividend of 8 per cent. was declared, and the manager's report showed a net gain for the year of 18 per cent.

The Southampton Brick and Tile Company, of Southampton, N. Y., has been incorporated, with a capital stock of $10,000. The directors are Wm. T. Graham, Wm. F. Halsey, Wm. H. Seely, James E. Jennings and H. M. Howell.

A deposit of first-class shale, fireclay and coal has been discovered near Saginaw and a stock company has been formed by Saginaw gentlemen for the manufacture of paving, fire and pressed brick, tile, sewer pipe, terra cotta, and fire-proofing of all kinds.

The Sicily Asphaltum Company, Montreal, Canada, has elected officers and directors: President, J. M. Fortier; vice-president, James Cochrane; treasurer, George C. Clausen; secretary, Napoleon Vezina. Directors, Henry Bolze of New York, and John Lee.

The Oklahama Oil and Asphalt Company, Oklahoma, O. T., have leased large interests from the Chickasaw Company, at Fort Worth, Tex., and will develop them at once. The company will open several large asphalt beds, and propose to ship it out in large quantities.

An extensive deposit of asphalt, about three miles from Ardmore, I. T., promises to be an important industry. The deposit varies from 80 to 100 feet wide, and is easily traced for a distance of three miles. Asphalt dealers and operators from the south and east are interested.

The American Asphalt Co. has been incorporated at Columbus, O., by Columbus capitalists, with a capital stock or $100,000. The incorporators are G. W. Sinks, Gilbert C. Hoover, Henry S. Hallwood, Randolph Coleman, W. E. Guerin and Col. F. J. Pickard. The company has control of a large territory for the American asphalt found in Utah.

The Central Sewer Pipe Company, of Kansas City, Mo., of which Walter S. Dickey is president, has just closed a contract that will require the furnishing of one thousand cars of sewer pipe, the largest single order ever placed in this country. The pipe goes to the city of San Antonio, Tex., and will be laid by J. B. Hindry, of Denver, Colo., who has the contract for the work. The sale was made by A. H. Dickey, representing the Central Sewer Pipe Company.

A permanent organization, which will be known as the Western Sewer Pipe Manufacturing Association, has been formed by the sewer pipe manufacturers west of the center of the state of Illinois. It will meet at different points every three months to discuss matters relative to the trade, and the next meeting will be held in March at Monmouth, Ill. The officers are: L. J. Howard, St Louis, Mo., president; Wm. Hanna, Monmouth, Ill., vice-president; Walter S. Dickey, Kansas City, Mo., secretary and treasurer.

Mr. E. J. Smith, an extensive brick and tile manufacturer of North English, Ia., contemplates visiting the leading plants of Iowa and Missouri for the purpose of investigating the practicability and general advantages of a new kiln patterned after those now in use at North English and Ottumwa. The kilns permit of a continuous burning, but have no top or crown covering and require much less fuel, a cheaper kind of fuel, and may be built for one-third the cost and at the same time providing a corresponding capacity with the kilns now used by Mr. Smith.

A report has been filed by N. B. Abbott, receiver of the Ohio Paving Co., at Columbus, O., showing that on July 5, the date of his appointment, the assets were $345,406.76, and the liabilities $217,042.96, leaving an apparent surplus of $128,363.80. The present assets appear to be $175,638.60, not including the Hallwood patent, upon which no value has been placed. There are liabilities of $113,100, leaving a surplus of $62,538.60. The property yet unsold is the plant on Leonard avenue, valued at $130,584.27; the stone quarry at Fulton, O., worth $12,676.43; and some lots in Osborne Place addition, $1,800.

The brick manufacturers of Allentown, Pa., have effected an organization which will be known as the Allentown Brick Manufacturers' Association. Officers have been elected as follows: President, W. B. Huber; vice-president, Edwin Kichline; secretary, John J. Yingling; treasurer, Fred S. Roth; executive committee, W. B. Huber, John J. Yingling, John H. Nonnemacher, Jr., Jacob W. Grim and Charles C. Sensenbach. Prices for 1895 were adopted, as follows: Kiln-run and sink brick, $6 per thousand; hard, half-hard and clinkers, $6.50 per thousand; paving brick, $7.50 per thousand; pressed brick, $12 per thousand. The association will hold meetings on the second Thursday of each month.

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Mr. E. J. Smith, an extensive brick and tile manufacturer of North English, Ia., contemplates visiting the leading plants of Iowa and Missouri for the purpose of investigating the practicability and general advantages of a new kiln patterned after those now in use at North English and Ottumwa. The kilns permit of a continuous burning, but have no top or crown covering and require much less fuel, a cheaper kind of fuel, and may be built for one-third the cost and at the same time providing a corresponding capacity with the kilns now used by Mr. Smith.

A report has been filed by N. B. Abbott, receiver of the Ohio Paving Co., at Columbus, O., showing that on July 5, the date of his appointment, the assets were $345,406.76, and the liabilities $217,042.96, leaving an apparent surplus of $128,363.80. The present assets appear to be $175,638.60, not including the Hallwood patent, upon which no value has been placed. There are liabilities of $113,100, leaving a surplus of $62,538.60. The property yet unsold is the plant on Leonard avenue, valued at $130,584.27; the stone quarry at Fulton, O., worth $12,676.43; and some lots in Osborne Place addition, $1,800.

The brick manufacturers of Allentown, Pa., have effected an organization which will be known as the Allentown Brick Manufacturers' Association. Officers have been elected as follows: President, W. B. Huber; vice-president, Edwin Kichline; secretary, John J. Yingling; treasurer, Fred S. Roth; executive committee, W. B. Huber, John J. Yingling, John H. Nonnemacher, Jr., Jacob W. Grim and Charles C. Sensenbach. Prices for 1895 were adopted, as follows: Kiln-run and sink brick, $6 per thousand; hard, half-hard and clinkers, $6.50 per thousand; paving brick, $7.50 per thousand; pressed brick, $12 per thousand. The association will hold meetings on the second Thursday of each month.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Main street, at Visalia, Cal., is now paved, for three blocks, with asphalt.

Nearly one mile of cement sidewalk has been laid at Yankton, S. D., during the last year, at a cost of $5,000.

D. A. Hartwell, city engineer at Fitchburg, says that the city should build each year, at least one mile of macadam road.

The city of Sioux Falls, S. D., has expended $75,000 for street paving during the last year. The city now has two miles of paved streets.

The asphaltic pavement recently constructed on Jackson avenue, at New Orleans, La., has converted that thoroughfare into a handsome drive.

One mile of brick pavement was laid on Main street last year at Lyons, Ia., and an ordinance has been passed for another mile to be constructed during 1895.

Mr. Carpenter, representing the Warren-Scharf Paving Company, recently addressed the council of Winnipeg on Trinidad asphalt paving, and it is probable that contracts will be let there this year.

The report of J. A. Battles, superintendent of streets at Fitchburg, Mass., shows that during 1894 $28,150.15 has been expended for street construction. The purchase of a stone crusher and the city's surface dressing is recommended.

A brick pavement has been constructed on Twenty-sixth street, Chicago, by the Chicago City Railway Company. Three different kinds of brick were used, all being repressed. The foundation consists of a bed of cinders six inches deep, thoroughly rolled with a five-ton roller.

Under the supervision of A. Leslie Duvall, about nine miles of improved pavements have been laid in Baltimore, Md., during the last year. Asphalt and granite blocks have been the material used. This gives the city about thirty-five miles of paved streets.

The expenditure for sidewalks and curbing during the last yaer, in Winona, Minn., reached $40,670. The amount of walks and curbing laid are as follows: Stone curbing, 6,000 lineal feet; twelve-foot stone and brick walks, 30,000 square feet; six-foot stone and brick walks, 180,240 square feet.

Brattleboro, Vt., is leading the other towns in that state in road-making. The town owns a macadamizing plant and the cost of macadamizing is 35 cents per square yard.

The aldermen, at Winnipeg, Man., are engaged in a controversy as to which kind of pavement is best. While asphalt is favored, the heavy cost of it seems to be the obstacle in the way. The council has been asked to procure statements as to the comparative advantages of the various kinds.

O. R. Rauchfuss, Joliet, Ill., writes that during 1894 work was completed in that city as follows: Brick paving on Cass and Ottawa streets; McDonough street sewer in West and East sides; Spring street, sewer; Exchange street sewer; Ohio street steel bridge; Washington street steel bridge; Jackson street wood bridge; Ross street drain; Exchange street sidewalks; retaining walls in Exchange street, Hickory street and Hickory creek. The work nearing completion is: Sewers in Elwood and Columbia streets; Miller avenue steel bridge, and the laying of the West side water main.

Mr. Clifton Wise, of Chicago, has laid three and a half miles of brick pavement for T rail construction, at Atchison, Kan., in the following manner: The surface of the ground was leveled and rolled and a course of brick laid flat. On this was placed an inch of sand, and on this cushion was laid another course of brick on edge. Mr. Wise also laid one and one-half miles of 7-inch round bois d' arc block, or osage orange, which comes from Texas, and is very expensive. The foundation for this pavement consists of six inches of concrete, with a cushion of sand, on which the blocks are placed, and the interstices are filled with gravel and tar.

CONTEMPLATED WORK.

Street paving has been proposed for Merrill, Wis.

Street paving is being agitated again, at Hamilton, Ohio.

Some street paving will be done at Menasha, Wis., this year.

Paved streets are being agitated by the press, at Hoopeston, Ill.

A boulevard 100 feet wide and two miles long will be built at South Milwaukee, Wis.

Crushed stone is favored for paving the streets at Charlotte, Mich.

Better thoroughfares and sidewalks are being agitated for Bronxville, N. Y.

The question of street paving is being vigorously renewed, at Hamilton, O.

A number of streets will be paved at Dayton, O., during this year.

One mile of paving will be constructed at Arcola, Ill., during this year.

Improved street paving is being agitated by the press, at Martinsburg, W. Va.

Street paving for the business part of town is being agitated at Beardstown, Ill.

About forty-two blocks of brick paving will be laid at Davenport, Iowa, this year.

Brick or granite blocks is recommended for repaving sundry streets at Albany, N.Y.

Sundry streets will be repaved with asphalt and Belgian blocks, at Brooklyn, N. Y.

Twelfth street, between Topeka avenue and Tyler street, Topeka, Kan., will be paved.

The roadway of sundry streets will be paved with bituminous rock, at San Francisco, Cal.

Asphaltic paving is contemplated for a number of blocks of streets at Oklahoma City, O. T.

A petition has been made at Altoona, Pa., for paving Washington avenue with vitrified brick.

The city of Menasha, Wis., contemplates paving some of the streets during next summer.

A brick pavement is favored for Butternut street, from N. Salina to Manlius street, Syracuse, N. Y.

The property-owners on Platt street, between Main and Olive, Maquoketa, Ia., are in favor of paving.

La Salle street, Nebraska and Compton avenues, and twenty-two alleys, will be improved at St. Louis, Mo.

A macadamized road, from Excelsior Springs to Kansas City, Mo., by way of Liberty, is contemplated.

Ordinances have been adopted at Rock Island, Ill., for paving Twelfth and Elm streets, and Seventh avenue.

An ordinance has been passed at Pekin, Ill., which advocates paving during the spring and summer of this year.

O. R. Rauchfuss, city engineer at Joliet, Ill., writes that bids will be asked in the spring for paving 3,500 or 3,600 feet of Richard's street with brick, and about 6,000 yards of alleys with brick.

The city council at Argentine, Kan., has passed a resolution to pave King, Powell and Eleventh streets with macadam.

Declaratory resolutions have been passed at Franklin, Ind., for paving with brick, Water, Martin, and Madison streets.

Commercial street, between Harrison and Bridge streets, Peoria, Ill., is to be paved with brick on a concrete foundation.

The estimated cost of the proposed paving for Main street, from Depot street to Garfield avenue, Salem, O., is about $10,000.

The council at Marion, O., has in contemplation the paving of Delaware avenue and State, Church and South Main streets.

The Southwest Baltimore Improvement Association, Baltimore, Md., contemplates paving Ridgely, Bayard, Monroe and Penn streets.

The property-owners in Division street, Atchison, Kan., favor paving that street. Paving for N. Seventh street is also being revived.

A petition has been made, at St. Louis, Mo., for paving Washington avenue, from Taylor avenue to King's highway, with asphaltum.

Labelle street property-owners, from Fifth to Richard street, Cincinnati, Ohio, have petitioned for a pavement for the roadway.

Web. P. Bushnell, town engineer at Monticello, Ind., writes that considerable street improvement is contemplated for that town this spring.

A free country macadamized road is being considered by the Queens County Board of Supervisors, to extend from Brooklyn City line to Hempstead, N. Y.

An ordinance has been passed by the city council, at Waukegan, Ill., for paving five blocks of the business district with brick. Estimated cost, $24,000.

The property-owners on Mulberry street, from Water to Eighth, Evansville, Ind., are anxious for the street to be paved. Both asphalt and brick are favored.

The residents of Moreland township, Montgomery county, Pa., will vote, in February, on borrowing $50,000 with which to macadamize the main roads of the township.

Plans and specifications have been submitted, at Syracuse, N. Y., for paving three streets with asphalt, the aggregate mileage being more than three miles. The streets to be paved are: Mulberry, from Onondaga to Colvin street; Bellevue avenue, from Midland avenue to S. Geddes street; Fitch street, from W. Onondaga to S. Geddes street.

The board of public works at Kansas City, Mo., has approved resolutions for paving, as follows: Brick, Ninth, from Washington to Penn; Ninth, from Penn to Jefferson. Asphalt, Wabash, from Eighth to Ninth.

The specifications for the proposed street paving, at Antioch, Ill., provides for a macadam foundation, which is to be rolled, then covered with sand, and then the brick laid on edge. Stone curbing will be used.

Petitions have been made to the common council, at Bridgeport, Ct., for sheet asphalt paving to the amount of $109,000. Granite blocks have been recommended for paving Water street, from Golden Hill to Congress street.

Preliminary arrangements are being made at Mansfield, O., for the proposed paving of West Fourth street. The residents of the street are in favor of crushing the macadam on the street with heavy rollers before laying the brick pavement.

Chas. M. Kennedy, city clerk at Aurora, Ill., writes that the city council has passed ordinances for paving Fourth street with brick, and that another ordinance will be acted upon for paving Fox street with brick. Bids for paving Lincoln ave. were received January 19.

The board of public works, at Milwaukee, Wis., has recommended to council that Sixth street, from Sibley street to Smith avenue, be paved with asphalt, except the block between Cedar and Wabasha streets, which, on account of the grade, will be granite. Asphalt is also favored for St. Peter street if a new pavement is put down. Action was deferred on this until April 1.

A petition is being circulated at Milwaukee, Wis., asking for an asphaltic pavement on Galena street, between Fourth and Twelfth streets. The petition will probably be granted, with the exception of a block between Third and Fourth streets, which is too steep for asphalt, and virified brick will be used instead. Greenfield avenue, from Reed street to Eleventh avenue, will also be paved. The material has not yet been decided upon.

CONTRACTS TO BE LET.

New bids will be received for macadamizing Shiawassee street, at Lansing, Mich.

Bids are invited at Rock Island, Ill., until February 4, for improving sundry streets.

F. W. Puderer writes that bids will soon be asked at Belleville, Ill., for new street name signs.

Bids will be received until February 12, at Salem, Ind., for building two gravel and macadamized county roads.

Sealed proposals will be received at Avondale, O., until February 7, for the improvement of Rockdale avenue.

Sealed tenders are invited until February 20, at Ottawa, Canada, for the construction of asphalt roadway, with limestone curbings, in Sparks and Bank streets.

Sealed proposals will be received at Columbus, O., until February 5, for grading and paving Front street, and for grading and paving with macadam Sullivant avenue.

Sealed proposals are invited from contractors or dealers in cedar blocks, until February 28, at Fort Wayne, Ind., for No. 1 and No. 2 cedar blocks, 5 inches long, for repairing purposes.

Sealed proposals will be received at Toledo, O., until February 4, for the following: Paving Wisconsin street with vitrified fire-brick, together with the necessary grading, curbing and drainage; turnpiking Charles and Boyd streets.

CONTRACTS AWARDED.

The Sicilian Asphalt Paving Co. secured the contract for paving Bank street, at Allegheny, Pa., for $2,757.50.

The contract for laying asphalt pavements at Marshalsea was awarded to George L. Peabody, at Pittsburg, Pa.

Currie & Conn secured the contract, at Detroit, Mich., for supplying the city with cedar blocks, at $8.22 per cord.

The contract for paving Montgomery street, from Jefferson to Adams, at Syracuse, N. Y., was awarded to the Rock Asphalt Company, of Rochester.

The Indiana Bermudez Asphalt Co. was awarded the contract for paving East Washington street, from Michigan avenue to State street, Indianapolis, Ind., at $5.60 per foot.

Orders for nearly $7,000 worth of repairs on the asphaltic streets in New York city have been given to the Barber, the Sicilian and the Warren-Scharf asphalt paving companies.

The Barber Asphalt Paving Co. has been awarded contracts at Black Rock, N. Y., as follows: Carmine street, $6,482; Inwood place, $10,486; Esser avenue, $31,420; Skillen street, $23,179.

O. R. Rauchfuss writes that contracts have been awarded, in Joliet, Ill., to T. B. Townsend, Zanesville, O., for paving with brick, Exchange, Washington, Ottawa and Jefferson streets.

The contract for paving Third street, from Broadway to Waanta, at St. Paul, Minn., was awarded to Fielding & Shepley for $6,600. The pavement will be granite on a concrete foundation.

The Coaldale Brick and Tile Co., of Coaldale, Ala., secured the contract for paving Fifteenth street, at Tampa, Fla., for $1.28 per square yard. The street will be paved with vitrified brick, with dressed top granite curbing 4x18 inches.

Contracts for sidewalk construction have been awarded at Omaha, Neb., as follows: Stone walks of Colorado sandstone and Indiana and Ohio stone, Hugh Murphy; wooden crosswalks and sidewalks, Jas. R. Connelly; artificial stone walks, A. Stutzer & Co.; Kansas stone, A. B. Cole.

Syracuse, N. Y., has let contracts for paving the following streets with sheet asphalt pavement: Montgomery street, 5,230 square yards for $18,953, to the Rock Asphalt Pavement Co., of Rochester, N. Y.; Franklin street, 3,880 square yards for $13,550, to the Syracuse Improvement Co. Bids have been received on the following streets: Bellevue avenue, 15,200 square yards sheet asphalt, 2,250 square yards sandstone block pavement, Trinidad Asphalt Refining Co. lowest bidder at $47,897; Fitch street, 7,120 square yards asphalt, Bermudez Paving Co. lowest bidder, at $19,459.80.

SEWERS.

The sewers laid at Rockford, Ill., during 1894, aggregate two miles, making a total of more than twenty-eight miles of sewers in the city.

The Delgany sewer, when completed, will be of much greater magnitude than is now realized by the people of Denver, Colo. About 22,000,000 gallons of sewerage will flow through it daily.

Steward & McDermott, the contractors who have the contract for 135 miles of sewers at New Orleans, La., estimate that it will take three years to complete the work.

The question of sewage filtration is under consideration at Altoona, Pa., and Mr. Harvey Linton, the city engineer, has recently reported the results of his investigation of the different methods.

Marinette, Wis., has over eight miles of sewers constructed, about one-third of the system provided for in the plans. The system will be completed as the citizens in the different parts of the city petition for them.

The amount expended for sewers in 1894, at Fall River, Mass., was $66,807.51, an excess of $28,910.32 over the amount expended in 1893. In the inaugural address of the mayor, he advises the use of the most improved apparatus in the construction of sewers, as a means of completing the work more rapidly, and conferring the benefit to be derived from their completion upon a large portion of the community.

C. P. Sheldon, city engineer at Lancaster, O., writes that the sanitary sewer system at Nelsonville, O., has just been completed by Louis Mayer, of Lancaster, and it is giving satisfaction. The work consisted of about five miles of pipe from 6 to 18 inches, one mile of which was laid from 20 to 27 feet deep, the entire depth of the trench going through fine gravel.

The Baltimore sewerage commission, Baltimore, Md., has submitted a report to Mayor Latrobe, in which it recommends a further appropriation of $20,000 with which to carry on its work. The commission was appointed in 1893 to prepare a plan for a general house-sewage system, and was given an appropriation of $5,000 to defray office expenses, necessary surveys, and the compiling of information on the subject of sewage.

The new sewer mains of Paris, crossing underneath the Seine, from Clichy to Asnieres, has been formally dedicated. The work was begun in 1889, and will not be completed for fourteen years or more. It is an enormous undertaking, intended to take away all the sewage of Paris from the waters of the Seine. Many difficulties have been encountered which it took a long time to overcome. The tunnel under the Seine is 1,543 feet in length, and 8 feet 6 inches in diameter.

The Negley run sewer system, Pittsburg, Pa., is completed. It is one of the most important systems in the city, draining, as it will eventually, Homewood, Brushton, and nearly all of the territory between Highland avenue and the east city line north of Fifth avenue. The entire length of the main sewer is 4½ miles. At its mouth the sewer is 9½ feet in diameter, but it gradually diminishes in size to 2 feet. The estimated cost was $200,000, but it has been constructed at a cost of $148,000.

CONTEMPLATED WORK.

A sewerage system is being agitated for Newport, Me.

A sewerage system is contemplated at Kewanee, Ill.

A sewerage system is being agitated for Vineville, Ga.

A sewerage system has been proposed for Maquoketa, Ia.

A sewage farm is being agitated for Rochester, N. Y.

Sewers will be built in sundry streets at Los Angeles, Cal.

A sewerage system is being agitated for Bronxville, N. Y.

A trunk sewer, five feet in diameter, and costing $100,000, is proposed for the western part of Auburn, N. Y.

The sewerage question has been defeated at Claremont, N. H.

The Ball sewerage system is contemplated for Taunton, Mass.

Manchester, Va., will have a sewerage system on the Waring plan.

A sewerage system will be constructed at Menasha, Wis., this year.

A special appropriation is urged for sewerage purposes at Medford, Mass.

Action has been taken for securing a sewerage system for Greenwich, Conn.

Sewers will be constructed in sub-district B, main district 3, at Columbus, O.

More bonds for sewerage purposes have been recommended for Parkersburg, W. Va.

An ordinance has been passed at Waukegan, Ill., for building a sewer on Spring street.

Work on the proposed system of local sewers, at Woburn, Mass., will begin early in March.

The council at Wabash, Ind., will, in the near future, let the contract for a mile of sewers.

Resolutions were recently adopted at Evansville, Ind., for constructing sundry local sewers.

Martin's Ferry, O., has passed an ordinance for a complete system of sewerage and drainage.

The citizens of Newark, N. Y., are agitating the question of putting in a complete sewerage system.

Web. P. Bushnell, Monticello, Ind., writes that sewer improvements will be made next spring in that town.

A trunk sewer is contemplated at Salem, Mass., which is intended to accommodate Salem, Danvers and Peabody.

A sewerage system is being agitated for Jonston, Olneyville, R. I. A trunk sewer will be built in Plainfield street.

An ordinance has been passed, at Kansas City, Mo., providing for the construction of a sewer in district No. 43.

The board of trustees at Ontario, Cal., has called a special election for February 5, to vote on issuing sewer bonds.

A map has been made of a partial system of sewers, in place of the proposed general system, at Clinton, N. Y.

An ordinance has been introduced in the council at Scranton, Pa., for constructing a main sewer in sewer district No. 17, which embraces portions of the Eleventh, Twelfth and Nineteenth wards. Estimated cost of construction, $36,000.

A sewer in Fourteenth street, N. E., between F and G streets, has been added to the schedule for 1896, at Washington, D. C.

A pipe sewer will be constructed on South Eleventh street, between S. Orange avenue and Seventeenth street, Newark, N. J.

The sewer committee will ask for an appropriation of $23,000 for the proposed East End trunk sewer, at Bridgeport, Conn.

Plans and specifications for the contemplated system of sewerage at Carthage, O., are being prepared by E. F. Layman, of Cincinnati.

Luther Dean, Taunton, Mass., writes that the city government has authorized the mayor to petition the legislature for a sewerage commission.

The plans being prepared for the proposed sewerage system at Syracuse, N. Y., differs very little from the recommendations made last spring.

A sewerage system has been proposed for Bristol, Conn. An estimate of $50,000 has been made to construct the trunk line and the filtration beds.

Permission has been given the town of Kenmore, N. Y., to connect its Delaware street sewer with the sewer in Delaware avenue, in Black Rock, N. Y.

Malcolm D. Patterson has completed drawings of a topographical map and complete house sewage system at Norristown, Pa. The survey covers 46 miles of sewers.

Sewers will be built at Harrisburg, Pa., as follows: Walnut street, from Thirteenth to Eighteenth; Thirteenth street, from Kittanning to Berryhill, and in Thirteenth street, from Swatara to Berryhill.

An ordinance has been favorably considered at Pittsburg, Pa., for the construction of a system of sewers in the Twenty-first and Thirty-seventh wards, in Frankstown avenue, Bennett and Kelly streets, Hamilton, Brushton, and Park avenues, and Harriet, Blaine, and Tioga streets.

Sewers, to relieve the mains by distributing the sewage, have been recommended at Memphis, Tenn., as follows: De Soto, Gayoso and Turley to Linden, 2,027 feet, $4,500; twelve-inch sewer on Mulberry, from Vance to Beale, 400 feet, $1,400; twelve-inch sewer on Washington street, from east to west mains, 350 feet, $400; eight-inch sewer on Adams, from Center alley to Front street, $300.

CONTRACTS TO BE LET.

J. F. Wilson, city clerk at Grinnell, Ia. writes that bids will soon be asked for about seven miles of sewers.

Sealed proposals will be received at Cincinnati, O., until February 16, for constructing sewers in Guy and Van streets.

Sealed proposals will be received until February 5, at St. Louis, Mo., for the construction of sewers as follows: Clarendon avenue sewer, from Westminster to Bell avenue, 1,500 feet of 9 feet diameter brick sewer; Gasconade street sewer, District No. 1, 500 feet of 24-inch pipe sewer, 320 feet of 21-inch pipe sewer, 740 feet of 18-inch pipe sewer, and 1,020 feet of 12-inch pipe sewer.

CONTRACTS AWARDED.

The contract for the new outlet sewer, at Summit, N. J., was awarded to J. A. Hicks, for $2,000.

The contract for building a sewer in Landscape avenue, at Yonkers, N. Y., was awarded to John Madigan for $3,333.

The city council, at Hamilton, Ohio, awarded to Bartow & Clement the contract for the sewerage pumping station.

The contract for constructing the East Side drainage system, at Des Moines, Ia., was awarded to King & Kennedy, for $3,375.

B. R. Morton, Newport, Ky., writes that the contract for cleaning the 362 catch basins of the sewerage system was awarded to M. J. Prout, at 38 cents each.

Contracts for sewer construction have been awarded at Harrisburg, Pa., as follows: Geiger avenue, P. H. Vaughn, $1,159.80; Twelfth street, Ward & Stucker, $1,360.

The contract for furnishing the city of Chicago with 2,000 tons of 16, 24 and 36-inch iron sewer pipe was awarded to the Chattanooga Pipe Foundry Co., at $19.16 per ton.

Wm. Oetting, Ft. Wayne, Ind., has been awarded the contract for one mile of sewer, including 17 man-holes, at 52 cents per lineal foot. The average cut will be ten feet in clay soil.

The city council at San Antonio, Texas, awarded to J. B. Hindry, of Denver, Colo., the contract for the construction of a complete sewerage system, for $331,209. The system will comprise 74 miles.

Sewer contracts have been awarded at Allegheny, Pa., as follows: Davis avenue, Sloan, McIlvain & Ott Bros., $635.40; Benton street, Sloan, McIlvain & Ott Bros., $775; Lacock street, Thomas Tate, $342.50.

The contract for the big sewer to extend from Bloodgood's Essex Felting Works, to a point below the dam of the Rahway water-works, Rahway, N. J., will be built by Ex-Mayor William Chamberlain. The sewer will be 9,460 feet long, of 12-inch pipe, and will have a fall of twenty-six feet. Estimated cost, $10,000.

Ryan & Avery, of Watertown, N. Y., secured the contract for constructing the sewer system at Charlotte, for $13,534.78.

Udo Hesse, Saginaw, Mich., writes that the contract has been awarded Ernest Jochen for the construction of 1,600 feet of 48 and 72-inch brick sewer, with necessary catch-basins and man-holes, in Gratiot street, from Fayette to Bullock street. A cut of 21 feet will be constructed in tunnel. Contract price, $5,400.

WATER-WORKS.

The question of water-works has again been revived at Centerville, Iowa.

The citizens of Millville, Pa., have voted to purchase or build water-works.

An extension of the water-works system is contemplated at Chatsworth, Ill.

The city of Cadiz, O., has decided to put in a 2,000,000 gallon pumping engine.

A new water-works pumping-plant is considered necessary at South Bend, Ind.

The council at New Albany, Ind., favors the purchase of the water-works system.

A pumping station with an adequate supply of water will be erected at Ellenville, N. Y.

The construction of a system of water-works is favored by the citizens of Canaseraga, N. Y.

The village of Cattaraugus, N. Y., has voted to build water-works to be owned by the village.

An additional reservoir will be erected at Belleville, Ill., with a capacity of 100,000,000 gallons.

The water-works question at Casey, Ill., will not be submitted to a vote of the people until spring.

A franchise has been granted Philadelphia capitalists, for a water-works plant at Sea Isle City, N. Y.

The plans for the proposed new water-works at Dalton, O., have been submitted to the board of health.

The contract for the water-works at Hopkinsville, Ky., has been awarded to Jesse W. Starr, of New York.

South Chicago is agitating a better water supply at Chicago, Ill. A twenty-four-inch main is proposed for relief.

The city council at Grand Island, Neb., are considering methods for the improvement of the water-works system.

The King of Belgium offers a prize of $5,000 for the best plan of supplying Brussels with drinking water, the competition in presenting plans being open to the world.

The laying of about four or five miles of water mains is contemplated at Pana, Ill. The work is to be done next summer.

The contract for the water-works at Key West, Fla., has been awarded to the Virginia Paving and Construction Co.

A franchise has been granted to J. R. Truesdale, St. Louis, Mo., for the construction and operation of a system of water-works, at Carbondale, Ill.

The city council at Carrollton, Ind., has passed resolutions favoring the erection of water-works, provided they can be built for the funds appropriated—$20,000.

Bids for the construction of a system of water-works at Quincy, Ill., will be advertised some time in February, 1895. Hiram Phillips, C. E., of St. Louis, is preparing the plans and specifications.

The council at Minneapolis, Minn., has accepted the proposition to establish a water reservoir on Lowry Heights, and has voted $75,000 to defray the preliminary cost of building the reservoir.

Water-works are being agitated as follows: Chester, Ill.; Richmond, Mo.; Salem, O.; Norborne, Mo.; Colchester, Ill.; St. Clair, Pa.; Caledonia, N. Y.; Sabetha, Kan.; Rockwood, Pa.; Saugerties, N. Y.

The construction of water-works is contemplated at the following places: Northwood, Ia.; Deerfield, Wis.; Circleville, O.; Era, Ky.; Lowellville, O.; Minnesota, Minn.; Dawson, Ga.; Abbeyville, Ga.; Morristown, Tenn.; Duquoin, Ill.; Lancaster, Wis.; Hightstown, N. J.; Mendon, Mass.

CONTEMPLATED WORK.

Water-works are being agitated again at Winchester, Ind.

Le Roy, N. Y., voted on the water-works question, January 29.

Water-works will be constructed at Sebastopol, Cal., next year.

The village of Rockville Center, N. Y., has voted for water-works.

An increase in the city's water supply is urged at Washington, D. C.

Pottsville, Pa., will vote for the erection or purchase of water-works.

The citizens of Girardville, Pa., favor the erection of new water-works.

Specifications and drawings will be wanted at Petersburg, Va., for a reservoir.

Water-works have been favorably voted upon at Wapakoneta, O., and Meadville, Pa.

Web. P. Bushnell, Monticello, Ind., writes that that town contemplates putting in a system of water-works this spring.

The laying of 4,000 feet of water-mains, from the present northern city limits to Highland Park, has been proposed at Detroit, Mich.

The city council at Brenham, Tex., has accepted the proposition of the Brenham Water-Works Company, which offers to sell its entire plant for $40,000.

William L. Erskine, village clerk at Lowellville, O., writes that a special election will be called to vote on bonding the village for $28,000 for water-works and electric lights.

Water-works are being agitated at the following places: West Bend, Ia.; Sabina, O.; Wells Bridge, N. Y.; Cassville, Wis.; Plainview, Minn.; Topsham, Me.; Lancaster, N. Y.; Middletown, Ind.; Shelby, O.; Westmoreland, Kan.; Fairfield, Ill.; Chester, Ill.; Algiers, La.

The Pennsylvania State board of health has decided to recommend to the next Legislature the enactment of a law giving the board increased powers to enable it to prevent the pollution of the water supplying streams of the State, and the means to make inspections, and abate the causes.

The construction of water-works is contemplated as follows: Central City, W. Va.; Lockhart, Tex.; Nacogdoches, Tex.; Livingston, Tex.; Jonesboro, Ark.; Coffeyville, Kan.; Darien, Mass.; Montgomery, N. Y.; Dover, O.; Norborne, Mo.; Lyndonville, Vt.; Weimar, Tex.; Bronxville, N. Y.; Evanston, Cincinnati, O.; Hanover, Kan.

CONTRACTS TO BE LET.

Proposals will be considered at Waynesville, N. C., for a water-works system.

New bids will be asked for constructing a system of water-works, at Kaukauna, Wis.

Sealed proposals will be received at Forest City, Iowa, until February 12, for constructing a system of water-works.

Bids will be received at Dallas, Texas until February 19, for constructing a 36-inch wooden stave pipe line, 15,000 feet long.

Bids are invited at New Orleans, La., until February 9, for furnishing and laying 33,000 feet of pipe, 6-inch to 30-inch in diameter.

CONTRACTS AWARDED.

A franchise has been granted Wm. J. Young, of Easton, Pa., to construct and operate water-works at Pocomoke City, Md.

H. A. Collar, Grand Rapids, Mich., writes that the 15,000,000 gallon pumping engine, the contract for which was awarded to the Nordburg Manufacturing Co., of Milwaukee, Wis., is of the triple expansion horizon-

tal type, with three outside packed pump plungers. The pump is so designed that any one pump can be cut out of service and the other kept in operation. Its guaranteed duty is 145,000,000 pounds.

BRIDGES.

A new bridge is proposed for East river, at Green Bay, Wis.

A new bridge will be needed at Lacon, Ill., next year.

The free bridge question is being agitated at Clarksville, Tenn.

Bids will soon be asked for a steel bridge across Portage Lake, at Hancock, Ill.

A new high bridge, to cross the Mississippi river at Keokuk, Ia., is being agitated.

A bridge will be built over the east branch of Mahoning creek, near Danville, Pa.

The citizens of Freemansburg, Pa., have petitioned for a new bridge over the Lehigh river.

The new bridge across the river at Goshen, Ohio, has been taken away by an ice gorge.

The construction of a substantial bridge is being agitated at Miley, Ill., to cross the Kaskaskia.

A new bridge is considered necessary across Mill Creek valley at Twelfth street, St. Louis, Mo.

A bridge will be built across Rachel creek, between Quincy and Chestnut Sts., at Ironton, O.

A company will be organized to build a highway toll bridge over New river, at Lurich, W. Va.

A county bridge is contemplated at Grandview, Iowa, at the Yellow Banks, in Eliot township.

The citizens of Upton, W. Va., made a recent petition for a bridge to cross the Dunkard Mill Run.

A new bridge is proposed, at Florence, Ala., to cross the Tennessee river at the mouth of Cypress creek.

Plans and specifications are being prepared for the construction of the Fern street bridge, at Cincinnati, Ohio.

Two new bridges have been recommended for construction, at Atlanta, Ga., at Alabama street and at Broad street.

A new steel bridge has been completed at Ripley, Ill., at a cost of $3,482.50. It is 240 feet long, with an 80-foot span.

A new drawbridge will be built in the spring at Essex, Conn., to take the place of the one now spanning the North Cove bay.

An act authorizing the construction of a bridge across the Missouri river, near Jefferson, Mo., has been signed by the President.

The mammoth iron bridge, which was being constructed over the Eel river, near Brazil, Ind., was destroyed by the ice, January 21.

Plans are being prepared for a bridge, 180-foot span, steel double, with 24-foot roadway, and two sidewalks, at Fort Wayne, Ind.

The bridge spanning White river at the crossing of Whitewater river, near Richmond, Ind., has been condemned and closed against traffic.

The citizens of North Fairmount, O., have petitioned for a viaduct, 1,460 feet long and sixty feet in the clear, with two car tracks and sidewalks.

Surveys have been made for an extensive iron bridge across Maroon creek, near Aspen, Colo. The estimated cost is between $20,000 and $30,000.

The Indiana Bridge Company, Muncie, Ind., was awarded the contract for building an iron bridge between Miami and Wabash counties, in Indiana.

The Trumbull county commissioners awarded to the Youngstown Bridge Co. the contract for a three-span steel girder bridge, at Warren, O. Contract price, $7,500.

The Youngstown Bridge Company secured the contract for constructing a steel bridge over the Platte river at the foot of Thirty-eighth street, at Denver, Colo., for $16,000.

The East St. Louis and St. Louis Bridge and Construction Co., of East St. Louis, Ill., has been incorporated to build a bridge across the Mississippi river near the foot of Olive street.

Bids will be invited for constructing a steel bridge 750 feet long at Fredericksburg, Va. Specifications will also be furnished for several other bridges to be built of girder plate.

A bridge is to be built across East street, at Oakland, Cal., which will have two spans 160 feet long, and one 53 feet long. The roadway will be 20 feet wide, and will be covered with bitumen.

The contract for the construction of a bridge across Buffalo bayou, to connect the second ward with the fifth ward, at Houston, Tex., has been awarded to Ben A. Reisner, for $37,860.

A resolution will be offered in the council, at Syracuse, N. Y., urging the passage of a bill providing for the construction of a hoist or lift bridge, at the Crouse avenue crossing of the Erie canal.

Bids are invited at Butte, Mont., until February 12, for the construction and erection of a highway bridge across the Big Hole river at Upper Chalk Bluffs, about thirty-six miles west of Divide station.

E. P. Martin, chief engineer at Denver, Colo., writes that bids were received January 29 for constructing a pile bent bridge in three sections, aggregating 400 feet in length, across Lake Archer and Platte river, at Third avenue.

Bids are invited at Boonville, Ind., until February 6, for the erection of an iron bridge, the dimensions of which are: Main span, 110 feet; west approach, 25 feet, and east approach, 40 feet; iron piers, the main piers to be 33 feet high.

The contract for the new iron bridge, over Black river, at Gordon's Ferry, Wis., was awarded to the Chicago Bridge and Iron Company for $4,944. The contract provides for a main span 212 feet long, and a smaller one of 108 feet.

Bids will be asked, at Spirit Lake, Iowa, for an iron bridge across the Sioux river, on Silver Lake road No. 10, section 24, Silver Lake township, and for a wooden bridge across the Stony, between sections 16 and 21, Westport township.

The Wrought Iron Bridge Co., Canton, O., secured bridge contracts, recently, as follows: Lift bridge at Geddes street, Syracuse, N. Y., $7,300; superstructure of bridge at Pickardsville, N. Y., $5,267; iron swing bridge at Ohio street, Buffalo, N. Y., $5,624.

Sealed proposals will be received until February 5, at Frankfort, Ind., for the construction of a substructure of an iron bridge across Prairie creek on Washington street. Also, for a steel plate girder bridge across Prairie creek on Washington street.

The commissioners of Montgomery county, Pa., contemplate the erection of three bridges during 1895. One over the Wissahickon, in Whitemarsh township; one over Zacharias creek in Skippack township, and one over the Zacharias creek in Worcester township.

The county board of Menominee, Wis., has voted $8,000 to the city of Menominee, to aid in building an iron bridge over the Menominee, to replace the old wooden bridge, and funds will now be solicited from the Marinette county board to assist in building the bridge.

Plans have been made for two iron bridges which will be constructed at Pittsburg, Pa., next spring. One will cross the Allegheny river from a point on Butler street extension, west of Highland Park, to the new borough of Aspinwall, and the other will cross the large ravine at the main entrance to Schenley Park.

The park commission at Milwaukee, Wis., has asked the common council to pass an ordinance, and issue $20,000 of bonds, for the purpose of building two bridges across ravines in Lake park.

The completion of the new steel bridge at Turner, Kan., was one of the most important improvements in that county during 1894. It was built by the Wrought Iron Bridge Co., of Canton, O., for $34,950. The bridge consists of four spans, resting on four circular piers and one circular abutment. Each span is 198 feet in length and 30 feet high. It has a clear roadway 20 feet in width, and an approach on the north side of the bridge 440 long and the same width of the main structure. Each pier rests on 20 piling, which are of white oak. Each cylinder, the pier of which is 7 feet in diameter and 40 feet long, is built in eight sections, and filled with concrete composed of two parts sand, one part cement and five parts broken stone. The structure contains 700,000 pounds of steel.

PARKS.

A new park will be established at Columbus, Ind.

A public park has been suggested for Norfolk, Neb.

Anderson, Ind., will have two new parks next summer.

A new park scheme will soon be acted upon at Albany, N. Y.

The Flat Iron park, at Ashtabula, O., will be improved next spring.

The plans for the Corlears park, New York City, have been approved.

A stock company is being organized at Chillicothe, Mo., to establish a park.

The park commissioners, at Davenport, Ia., have purchased a site for a new park.

Plans for several new parks are being considered by the Park board, at Troy, N. Y.

The board of park and boulevard commissioners, at Kansas City, Mo., is planning for new parks.

A passage of the bill for establishing a national park at Gettysburg has been secured by General Sickles.

Citizens of the Fifth ward, at Boston, Mass., are agitating the purchase of 125 acres of land for park purposes.

A bill has been introduced in the Illinois Senate, asking for a special fund for the maintenance of parks and boulevards in cities of from 25,000 to 100,000 inhabitants by levying a tax of three mills on each $1 valuation of property upon a vote of the people.

The citizens of Dedham, Mass., voted recently to authorize the commissioners to petition the legislature for authority to borrow $100,000 for park purposes.

The board of park commissioners and the city council of Wilmington, Del., are trying to secure money for the parks. A draft of a proposed bill to the legislature provides for borrowing money to improve the eight parks of the city.

The board of park commissioners, recently organized at Chester, Pa., consists of five persons, who are not members of the council. They will have power to submit proposed plans for improvements to the parks, with estimated costs.

Charleston, S. C., has purchased 500 acres of land on the Cooper river, five miles from the city, for a public park. It has a natural growth of pine and oak trees. An avenue 100 feet wide will be constructed from Charleston to the gates of the park.

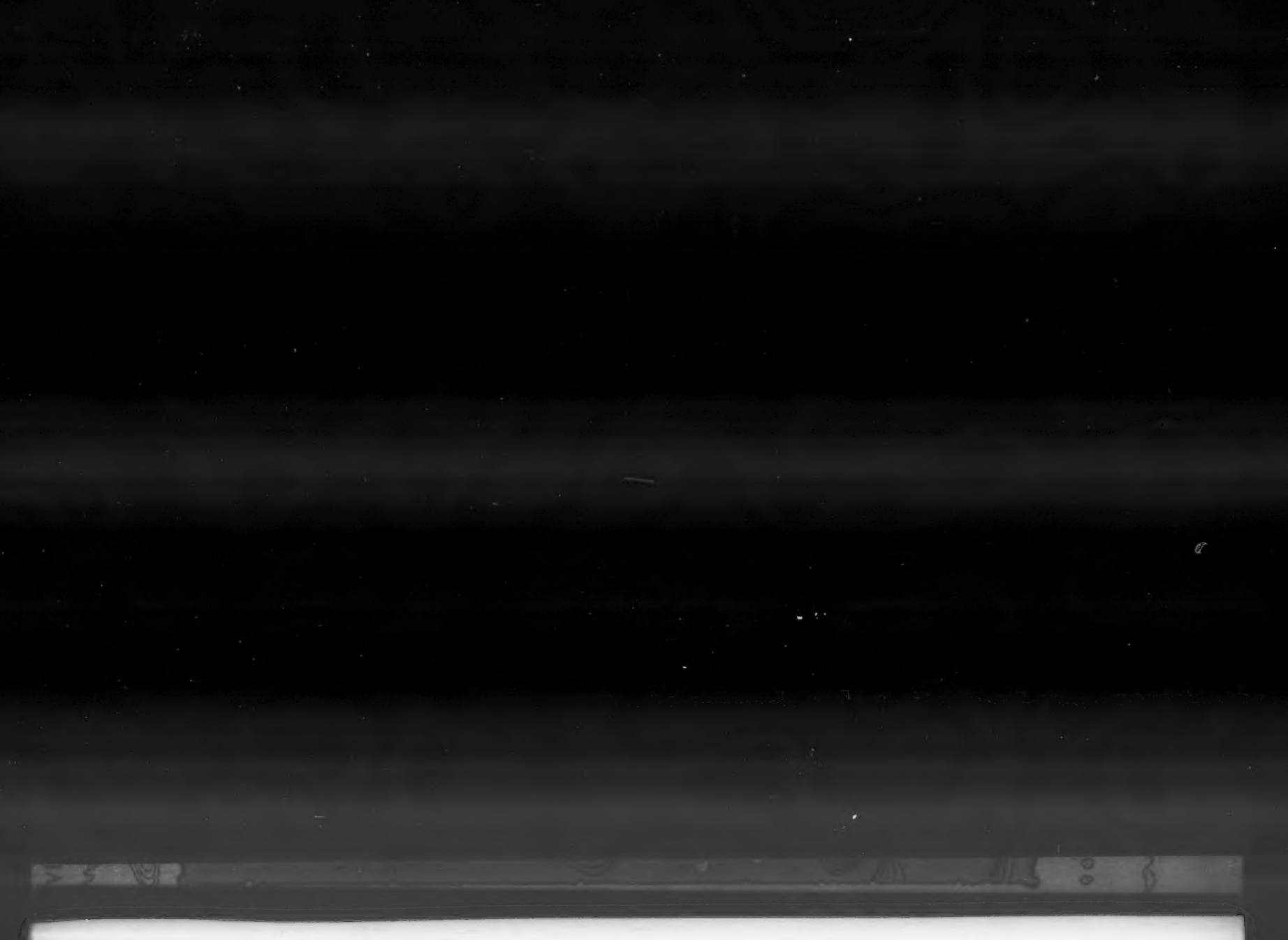
The Operative Builders' Association is urging the purchase of a strip of ground, near the Schuylkill river, for park purposes, at Philadelphia, Pa.

The park commissioners at Omaha, Neb., decided recently to ask for the minimum levy, one and one-half mills, for park purposes for the ensuing year.

MUNICIPAL BONDS.

Bids for water-works bonds will be offered March 11, at Lafayette, Ind.

Bids will be received at Avondale, O., until February 7, for the purchase of $4,000 of 5 per cent. bonds.

Bids will be received until February 12, at Fostoria, O., for the purchase of $11,000 of 6 per cent. sewer bonds.

Bids will be received until February 20, at Kamloops, B. C., for the purchase of $25,000 of 5 per cent. debentures.